US006244583B1

(12) **United States Patent**
Ohmichi et al.

(10) **Patent No.: US 6,244,583 B1**
(45) **Date of Patent: Jun. 12, 2001**

(54) **STACK TRANSPORT FOR A SORTER WITH PRESSING DEVICE**

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(73) Assignee: **Minolta Co., Ltd.**, Osaka (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/037,012**

(22) Filed: **Mar. 9, 1998**

(30) **Foreign Application Priority Data**

Mar. 11, 1997 (JP) 9-055706
Mar. 11, 1997 (JP) 9-055707
Mar. 11, 1997 (JP) 9-056116
Mar. 11, 1997 (JP) 9-056120

(51) **Int. Cl.**[7] **B65H 39/00**
(52) **U.S. Cl.** **270/58.09**; 270/58.11; 270/58.23; 270/58.07; 271/180; 271/220; 271/221; 414/791; 414/792.7
(58) **Field of Search** 270/58.01, 58.08, 270/58.09, 58.4, 58.12, 58.13, 58.19, 58.23, 58.07; 414/791, 792.7; 271/217, 220, 221, 222, 178, 180

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Primary Examiner—Christopher P. Ellis
Assistant Examiner—Patrick Mackey
(74) *Attorney, Agent, or Firm*—McDermott, Will & Emery

(57) **ABSTRACT**

A sheet handling apparatus which stores sheets ejected from an image forming apparatus in a bin, staples the sheets if necessary, takes the stapled or unstapled set of sheets out of the bin and transports the set of sheets up to a large-capacity tray nipping the set of sheets between rollers of a conveying gate to deliver the set of sheets onto the tray. While the conveyer gate is transporting the set of sheets upward, the set of sheets hangs down from the nipped portion, and the hanging-down portion is guided by a guide plate. A limit is set to the number of stapled sets of sheets which can be stacked on the large-capacity tray, and transportation of stapled sets of sheets to the tray by the conveyer gate over the limit is canceled. When a set of sheets is delivered onto the tray, pressing sticks press sets of sheets which have been stacked on the tray.

16 Claims, 52 Drawing Sheets

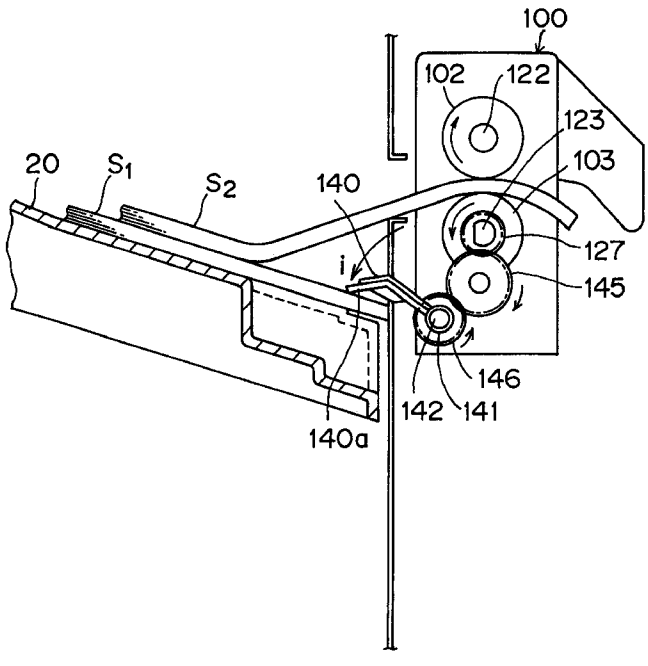


FIG. 1

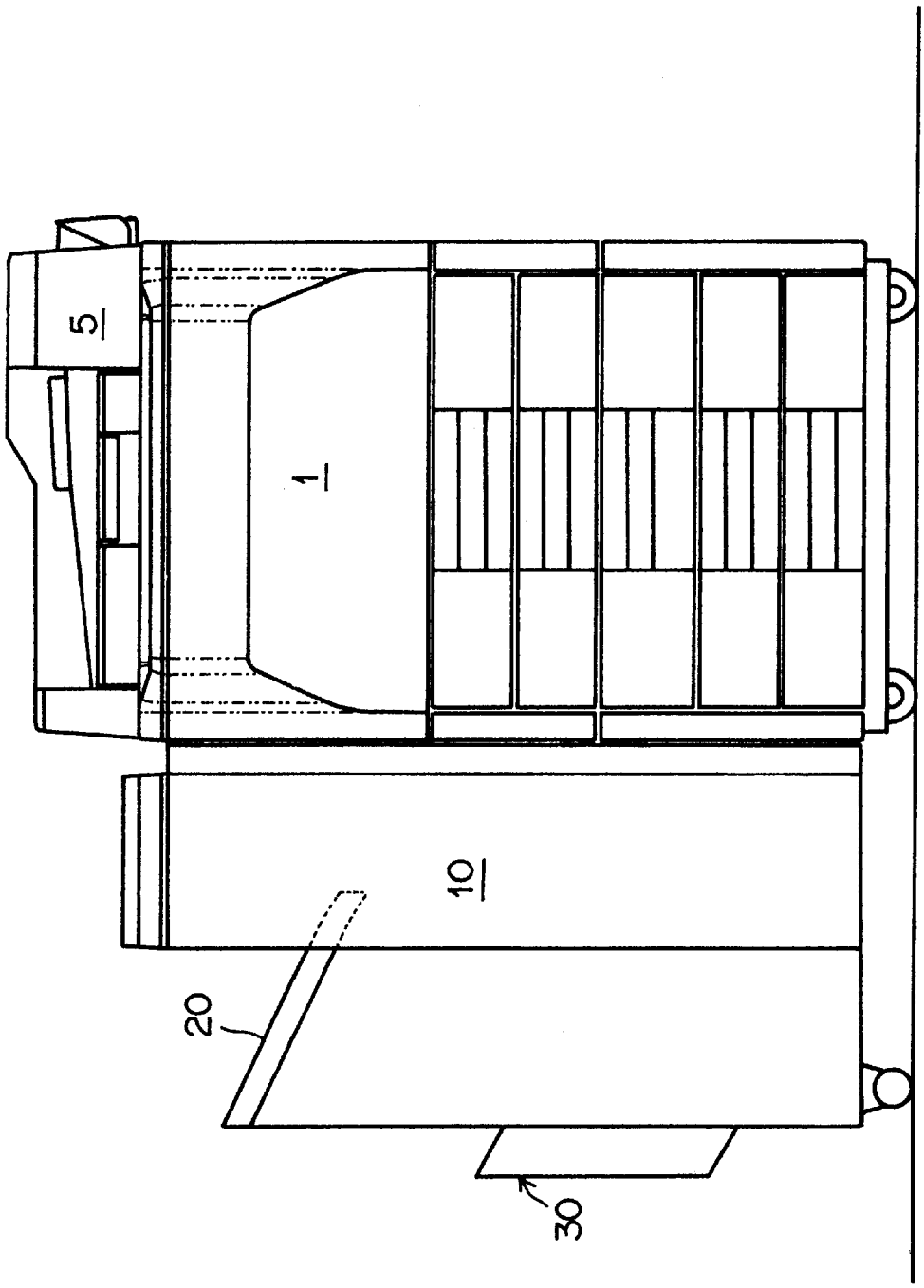


FIG. 2

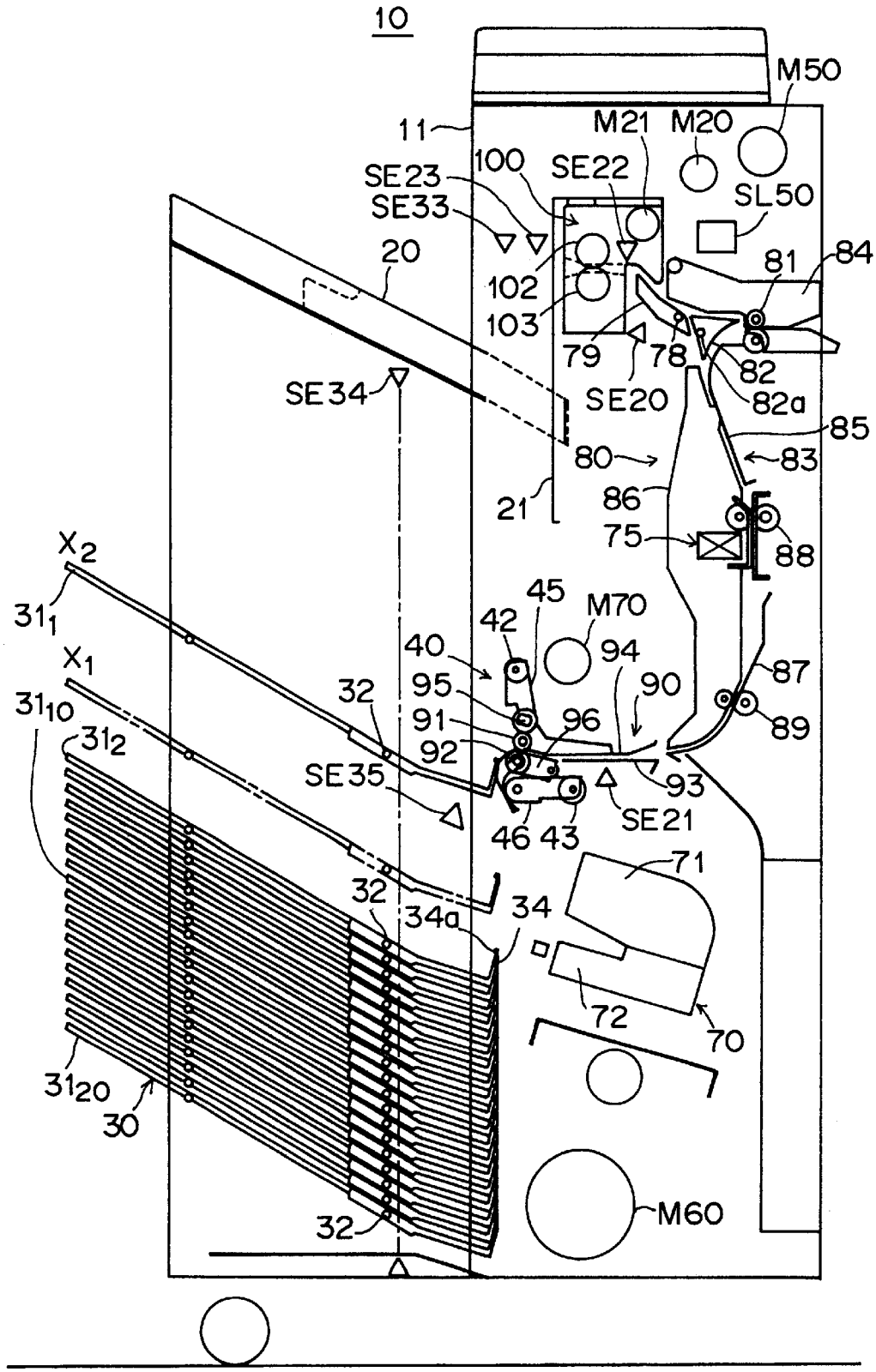
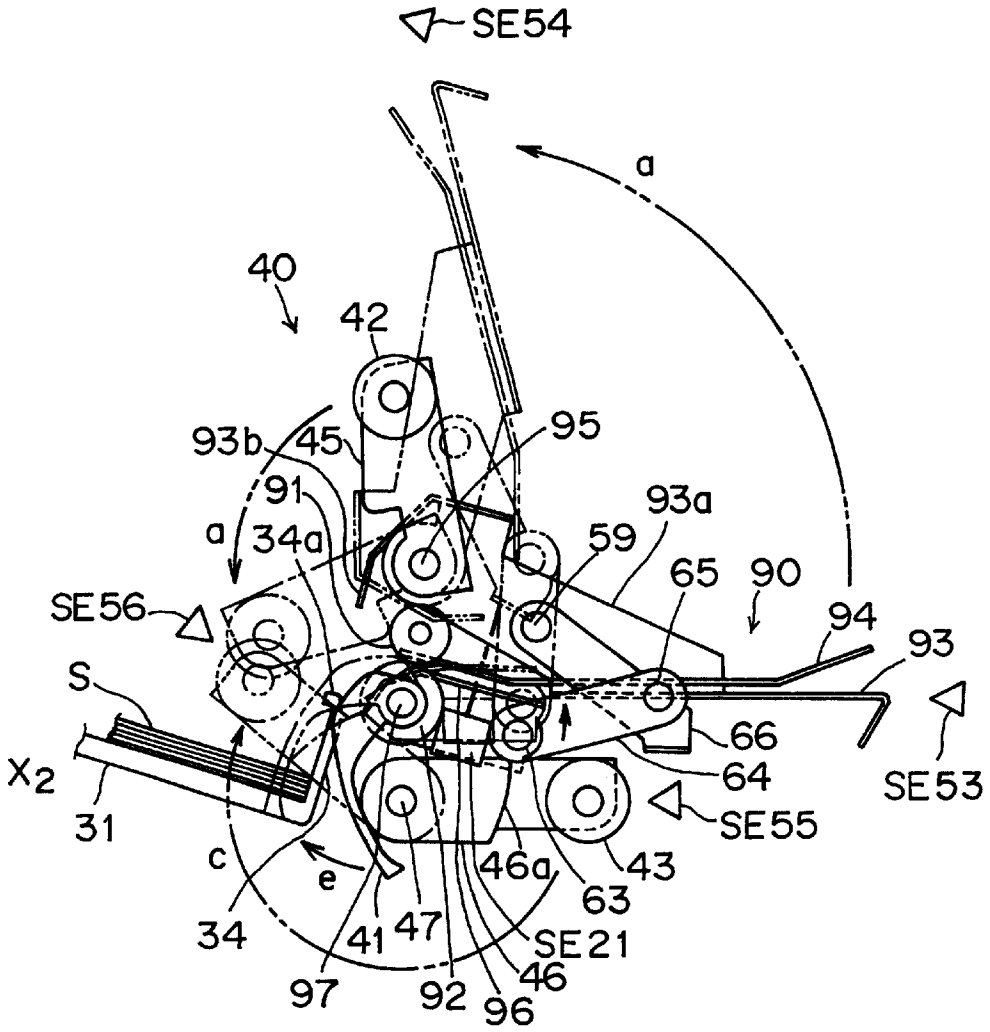

10
M50
11
M21
M20
100
SE22
SE23
SE33
SL50
20
81
84
102
103
79
78
82
SE34
SE20
82a
85
80
83
21
86
75
88
X2
45
M70
42
311
40
94
87
X1
32
95
90
91
96
89
310
312
92
SE35
93
SE21
46
43
71
32
34a
34
72
70
320
30
32
M60

FIG. 3


SE54
a
40
42
93b
45
95
91
93a
a
34a
59
65
90
94
93
SE56
S
66
64
SE53
X2
31
SE55
c
e
46a
43
63
34
41
47
SE21
46
97
92
96

F I G. 4

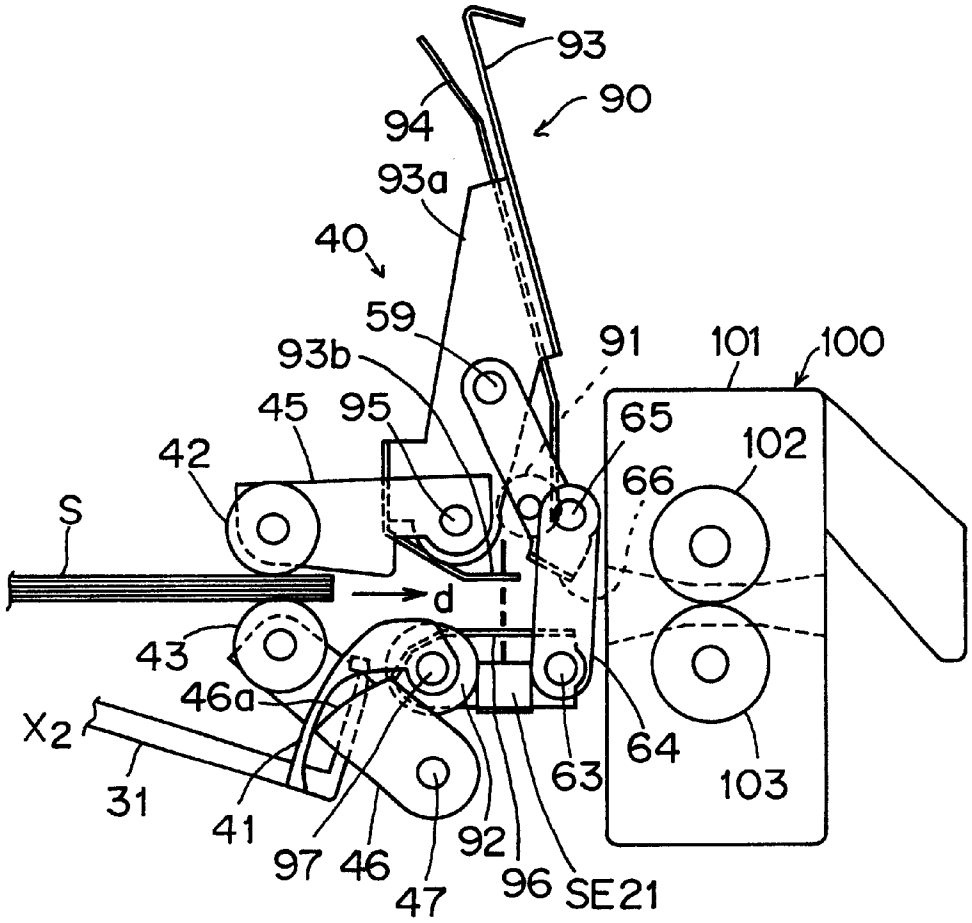

93
90
94
93a
40
59
91
101
100
93b
45
95
65
102
42
66
S
d
43
46a
64
X_2
63
103
31
41
97
46
92
96
SE21
47

FIG. 5

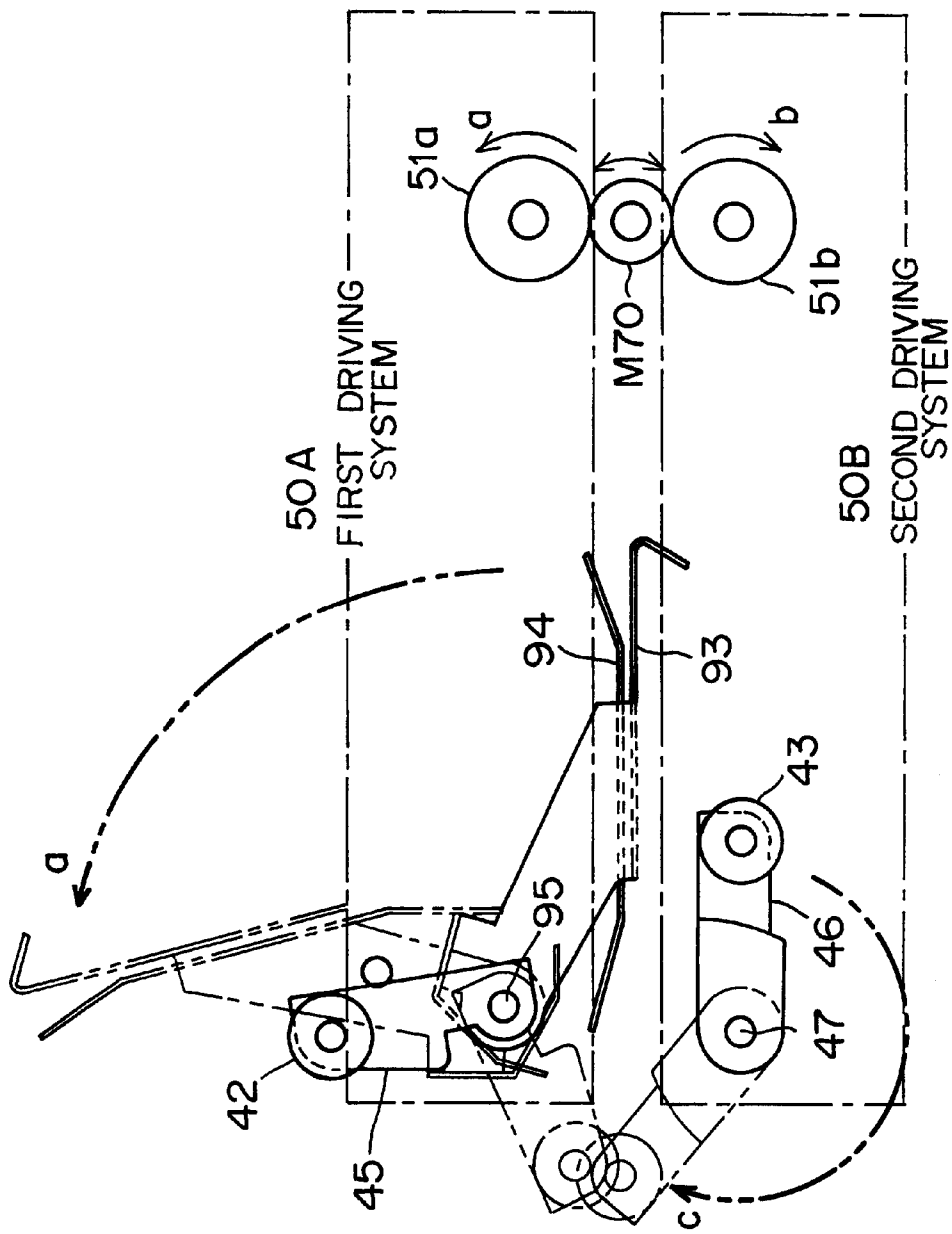

50A
FIRST DRIVING SYSTEM
50B
SECOND DRIVING SYSTEM
M70
51a
51b
a
b
c
42
43
45
46
47
93
94
95

FIG. 6

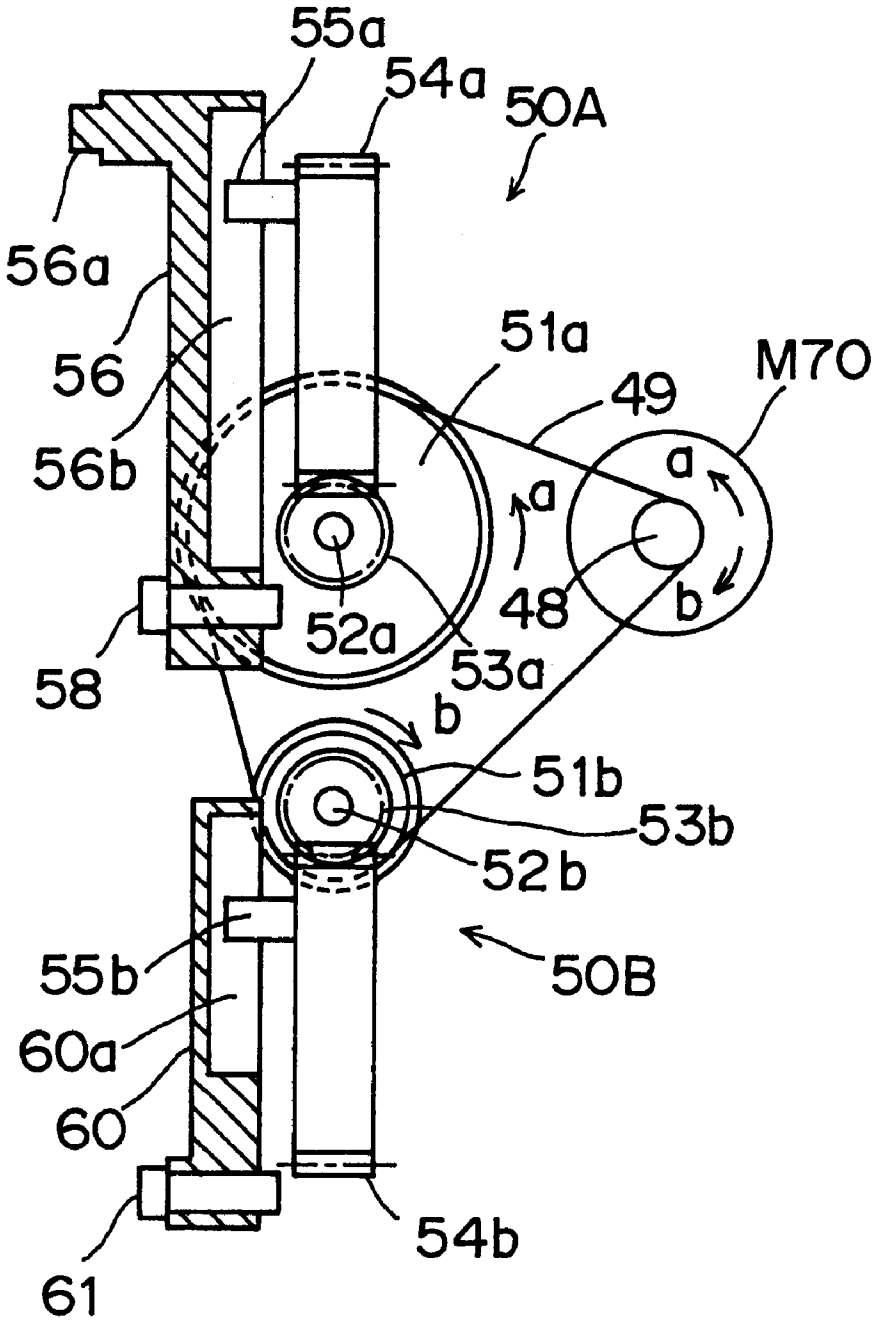

55a
54a
50A
56a
56
56b
51a
49
M70
a
a
48
b
52a
53a
58
b
51b
53b
52b
55b
50B
60a
60
54b
61

FIG. 7

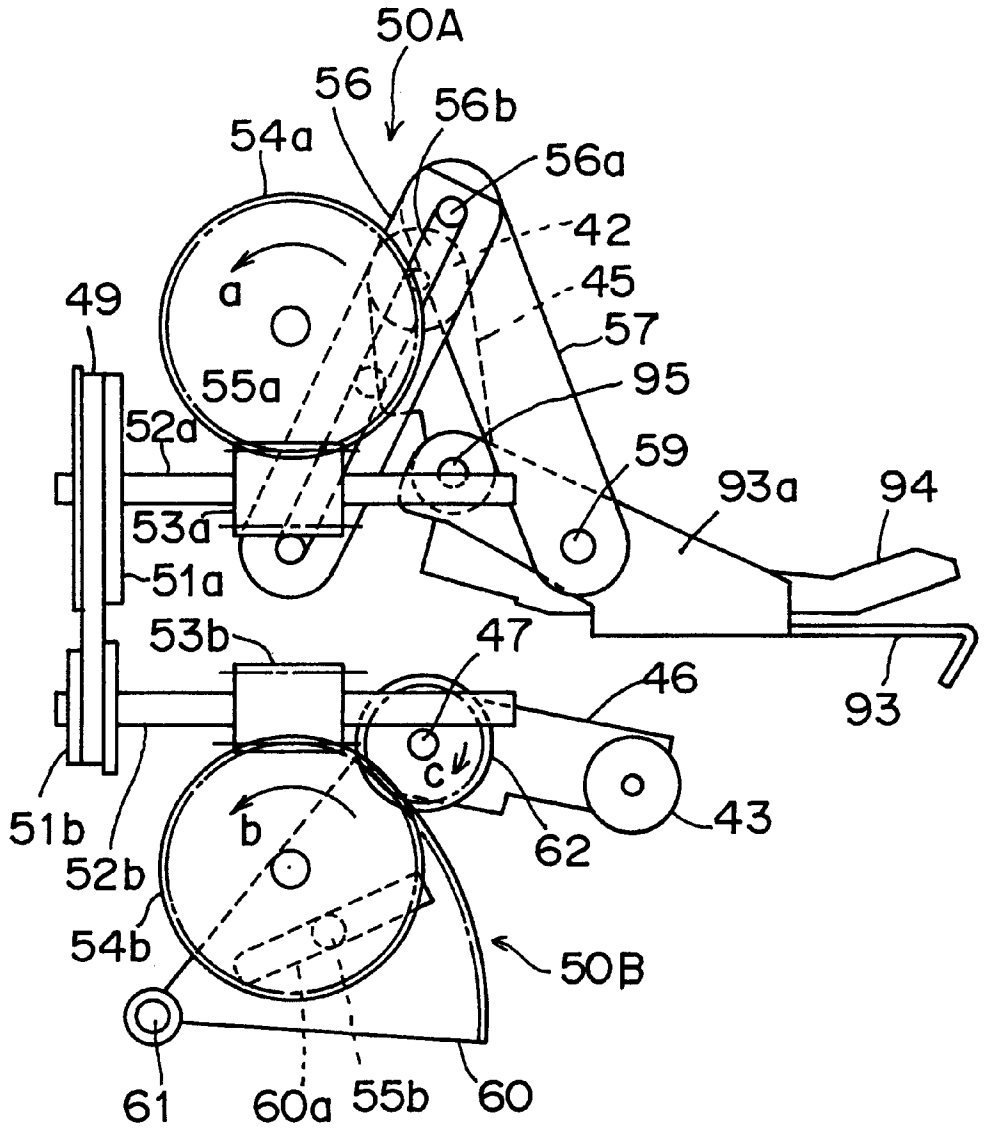

50A
56
56b
54a
56a
42
45
57
95
59
93a
94
93
49
a
55a
52a
53a
51a
53b
47
46
43
62
c
51b
52b
b
54b
50B
61
60a
55b
60

FIG. 8

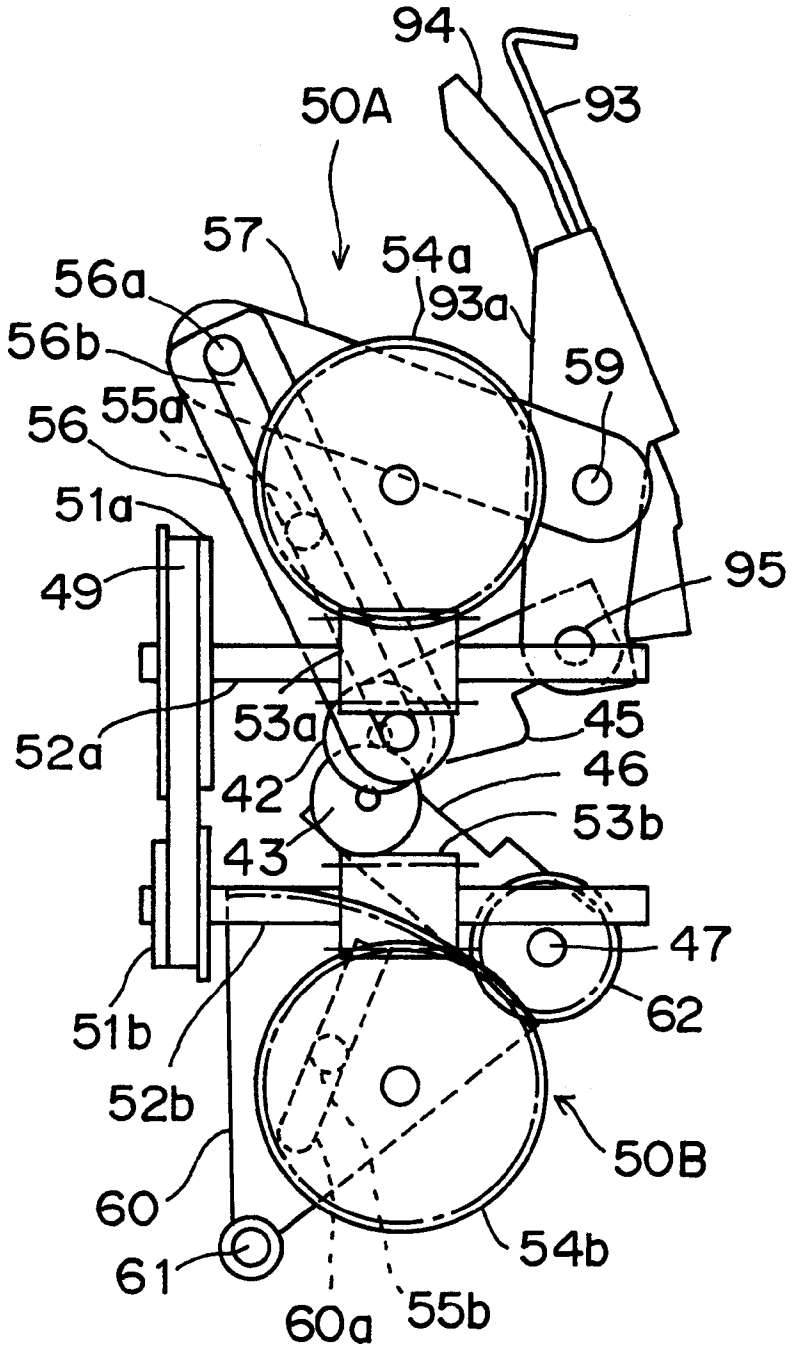

94
50A
93
57
54a
56a
93a
56b
59
55a
56
51a
49
95
52a
53a
45
42
46
53b
43
47
62
51b
52b
50B
60
61
54b
60a
55b

FIG. 9a

(A) BEFORE DRIVING

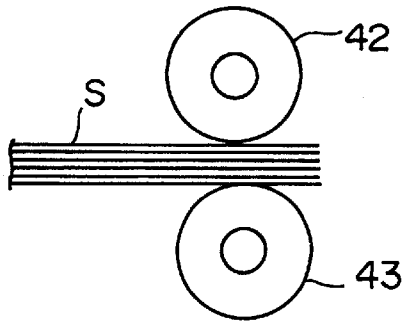


FIG. 9b

(B) AFTER DRIVING

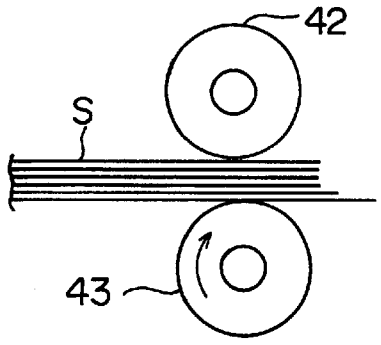


FIG. 10

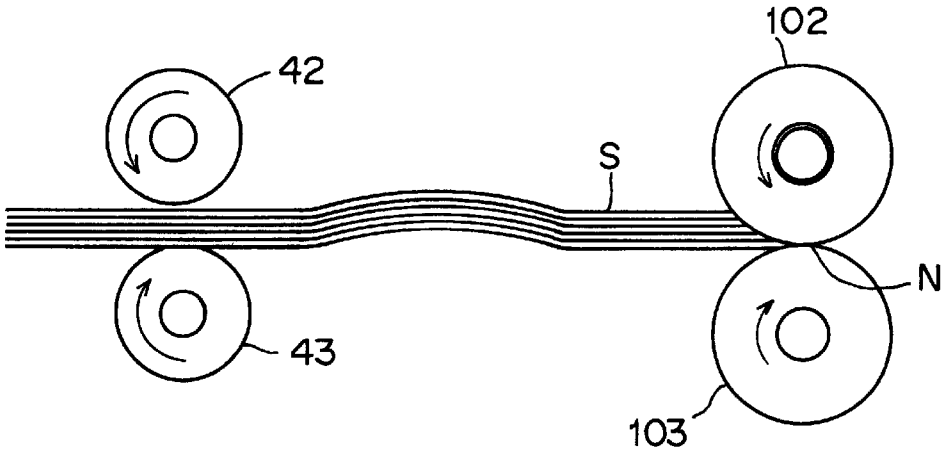


FIG. 11

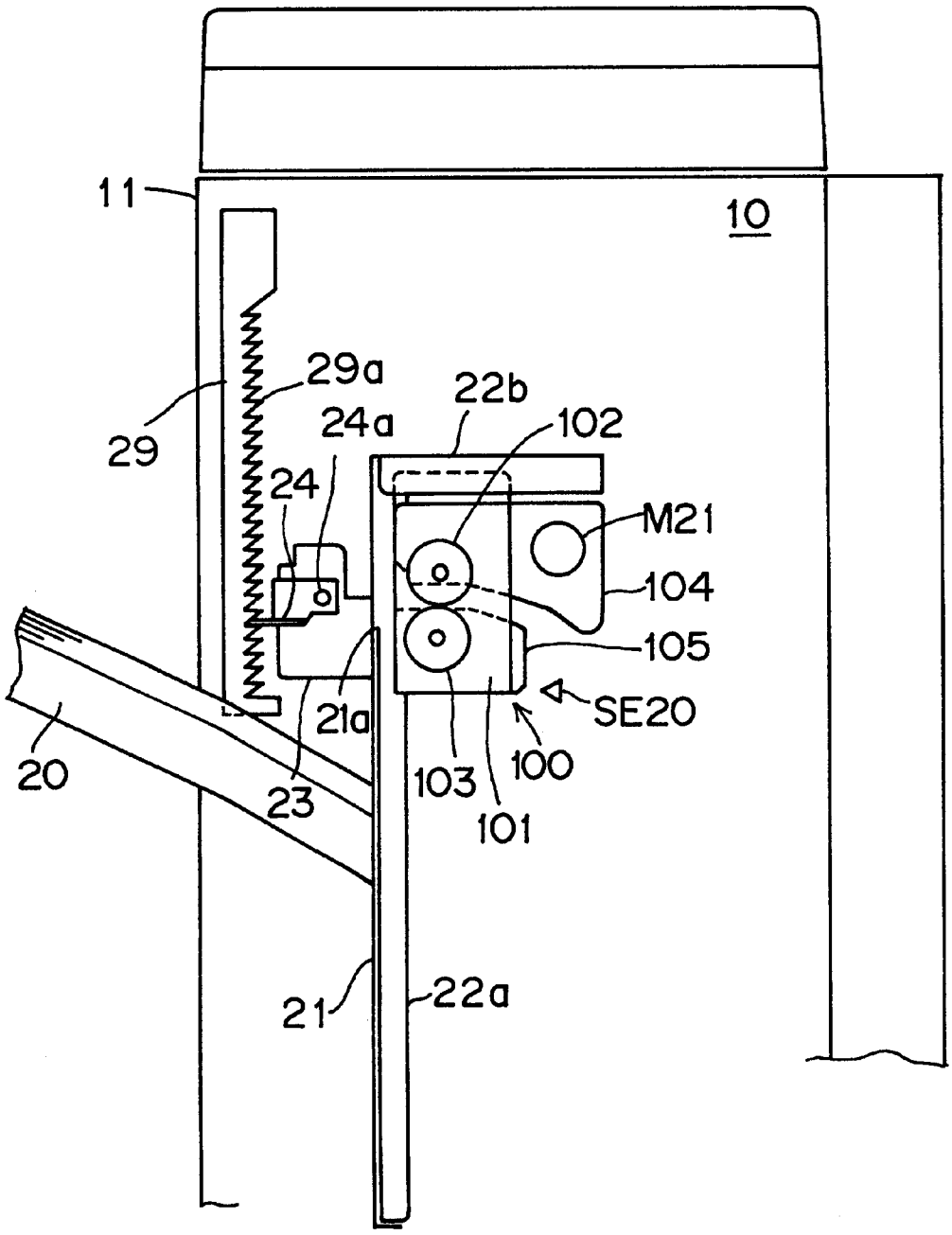

11
10
29a
22b
29
24a
102
24
M21
104
105
SE20
21a
20
23
103
100
101
21
22a

FIG. 12

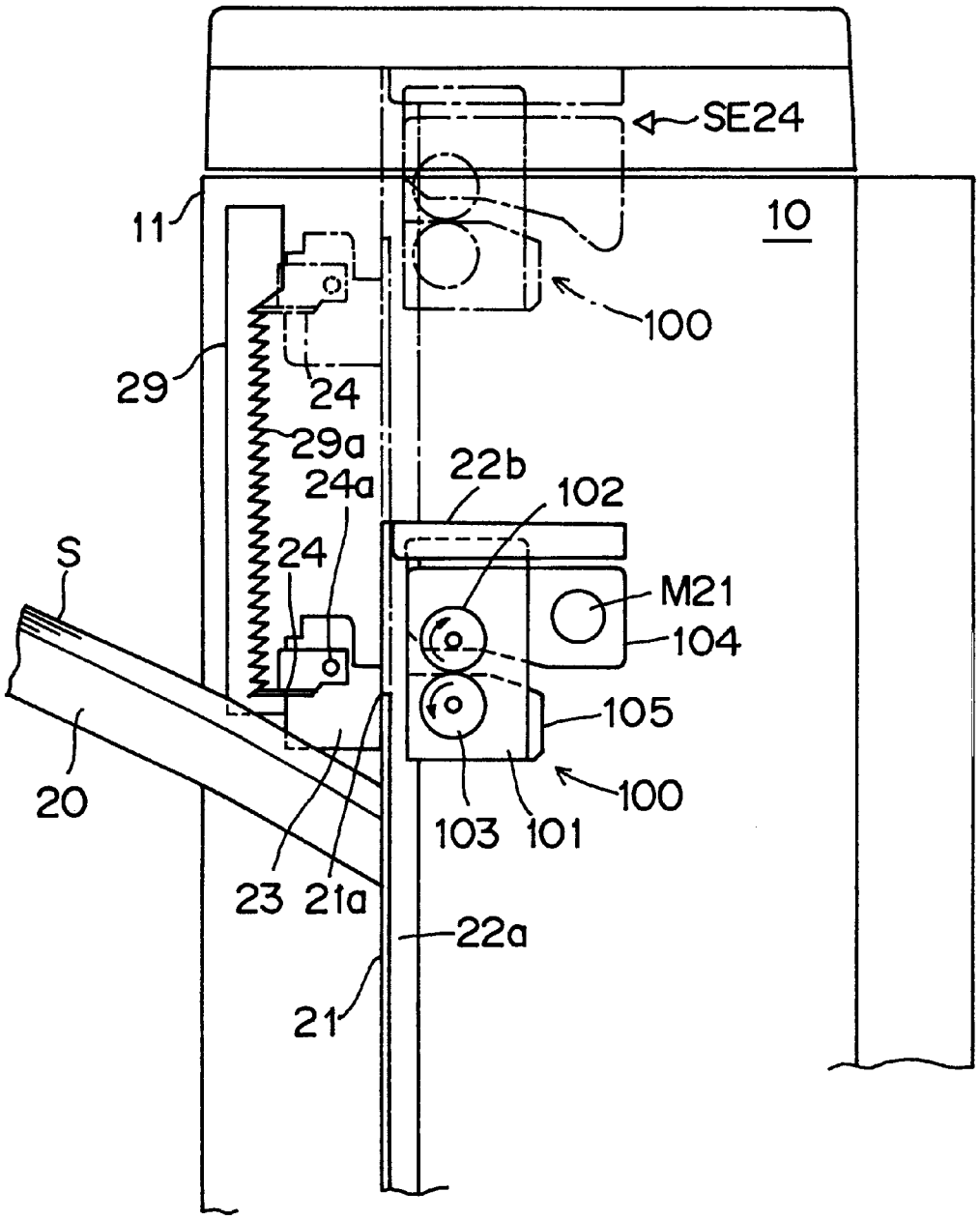

SE24
10
11
100
29
24
29a
24a
22b
102
S
24
M21
104
105
20
100
103
101
23
21a
22a
21

FIG. 13a

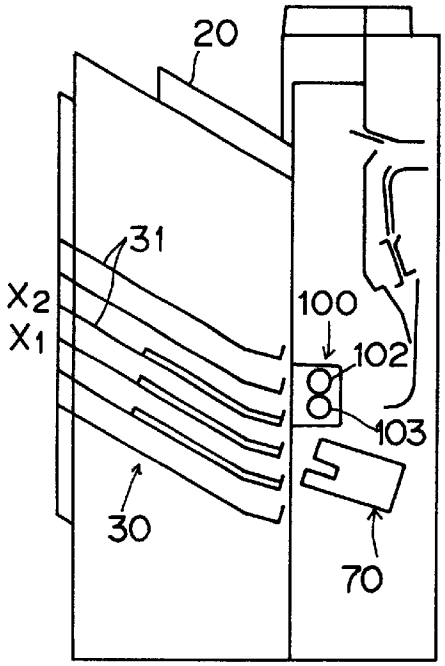


FIG. 13b

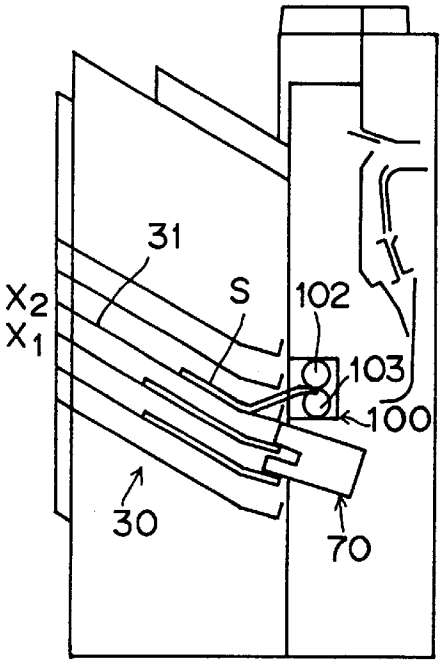


FIG. 13c

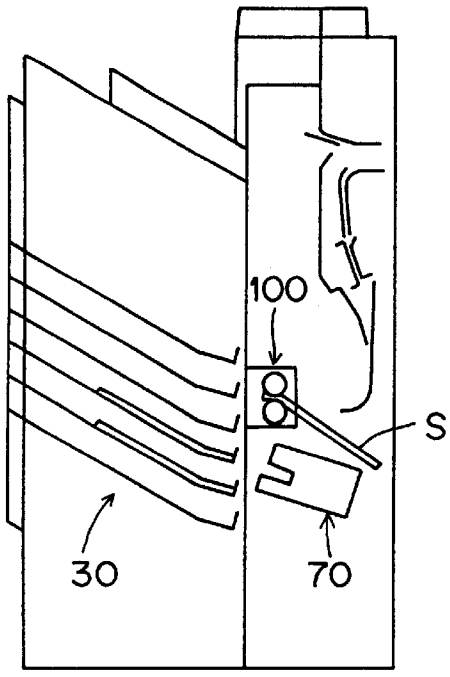


FIG. 13d

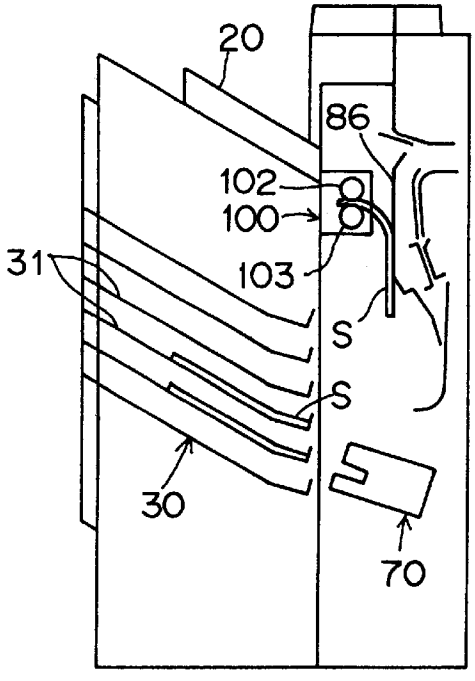


FIG. 13e

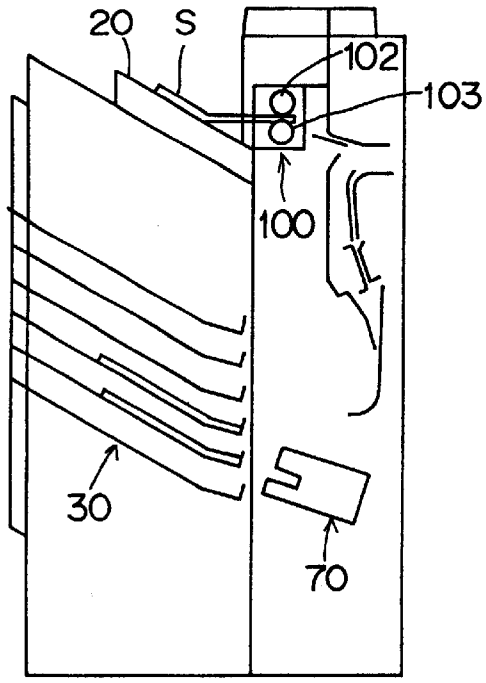


FIG. 13f

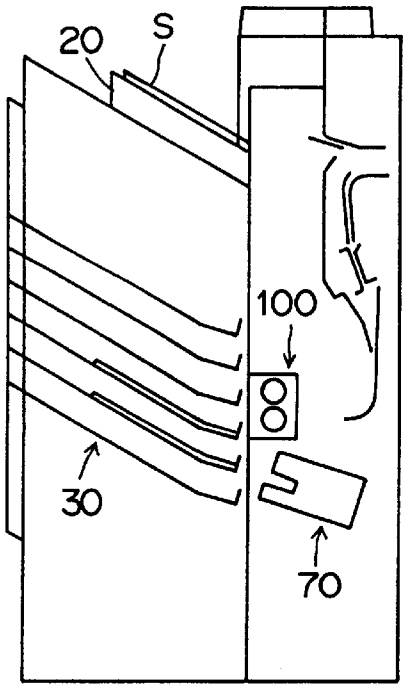


FIG. 14

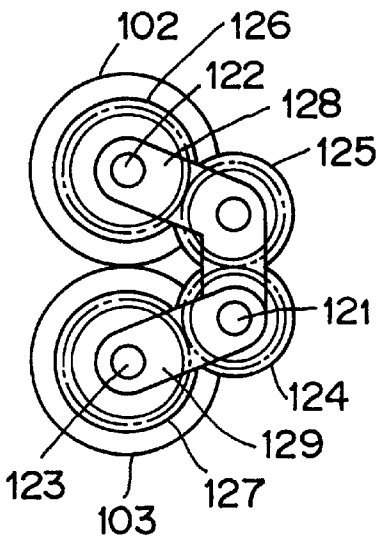

102
126
122
128
125
121
124
129
123
127
103

FIG. 15

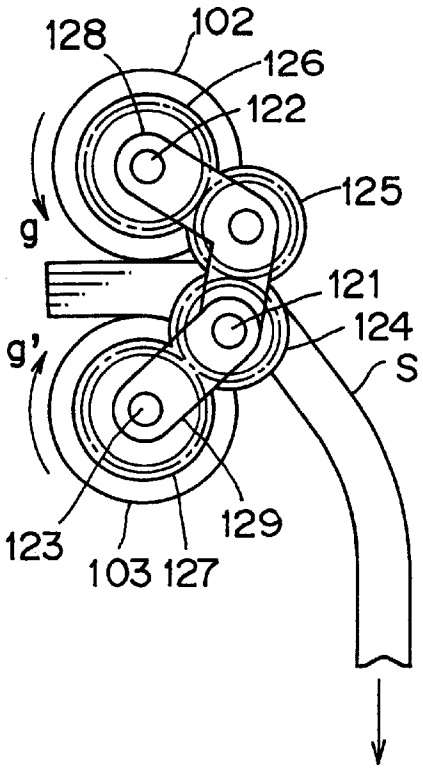

128
102
126
122
125
g
121
124
g'
S
123
129
103
127

FIG. 16

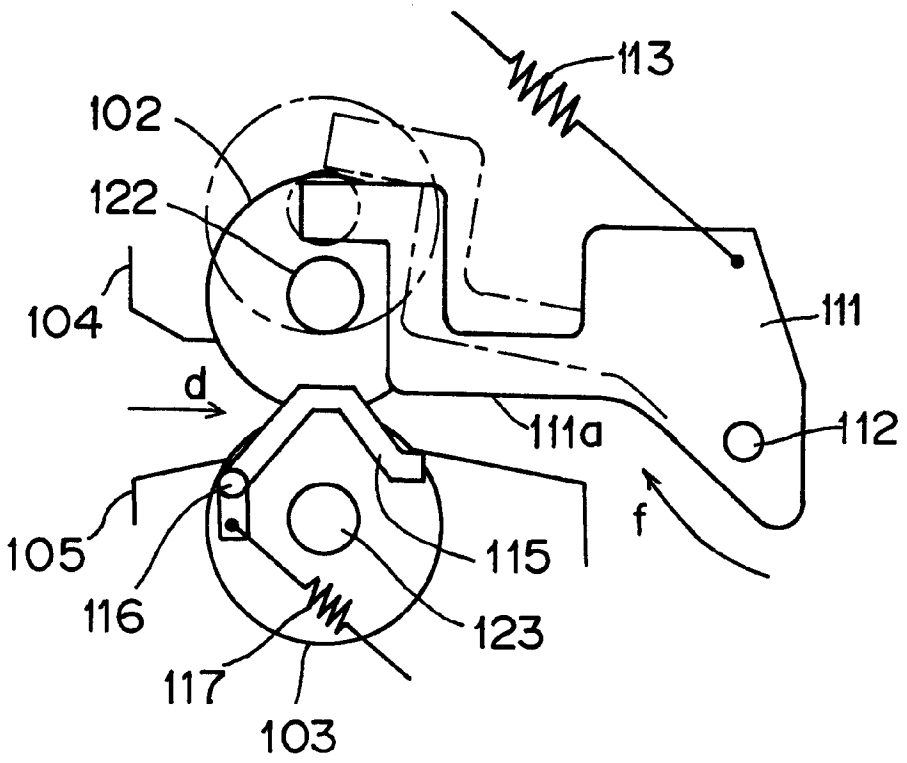


FIG. 17

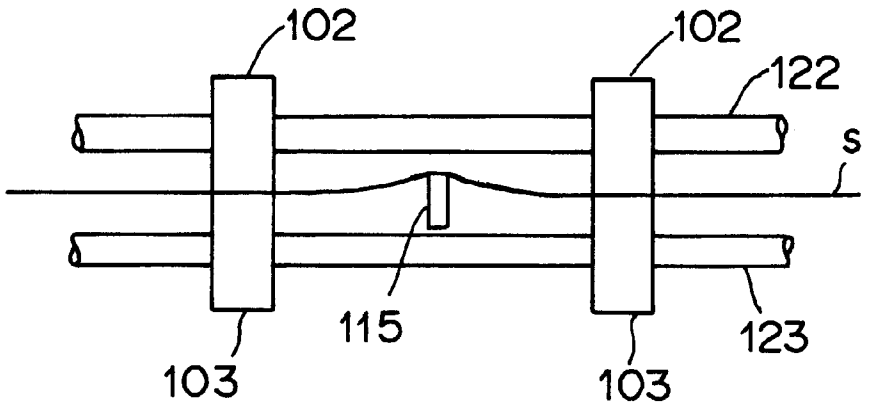


FIG. 18

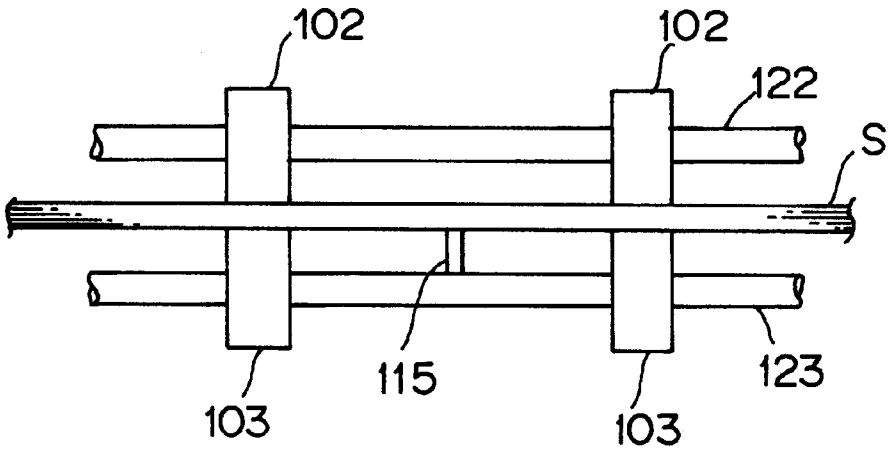


FIG. 19

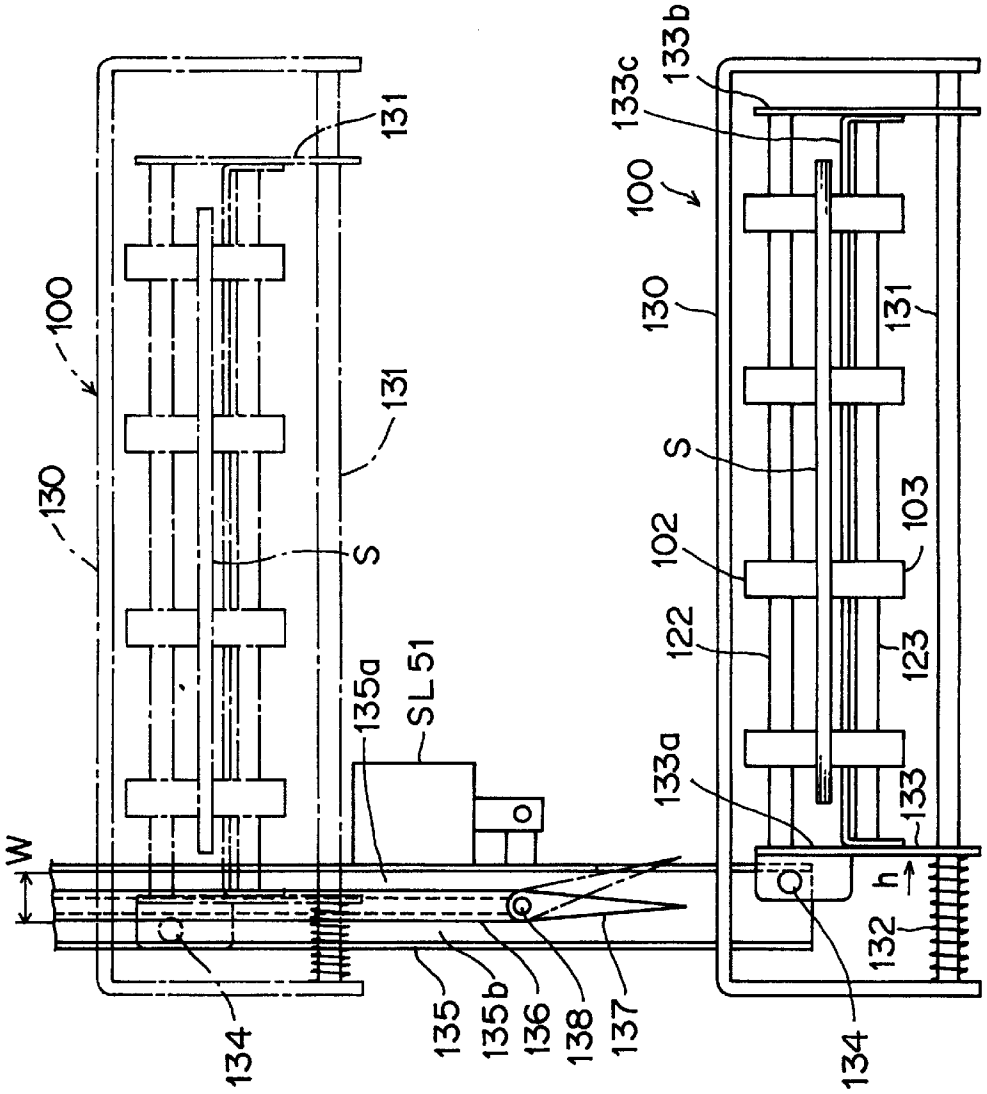

100
130
131
S
135a
SL 51
W
134
135
135b
136
138
137
133b
133c
100
130
131
S
103
102
122
123
133a
133
h
132
134

FIG. 20

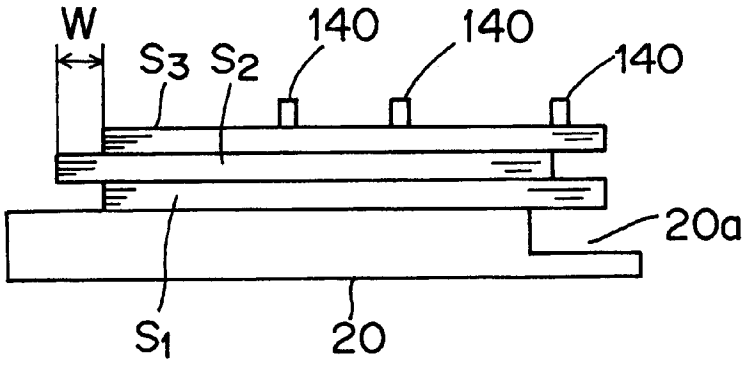


FIG. 21

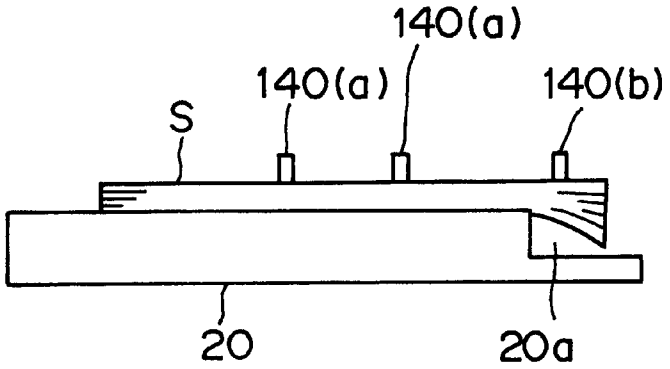


FIG. 22

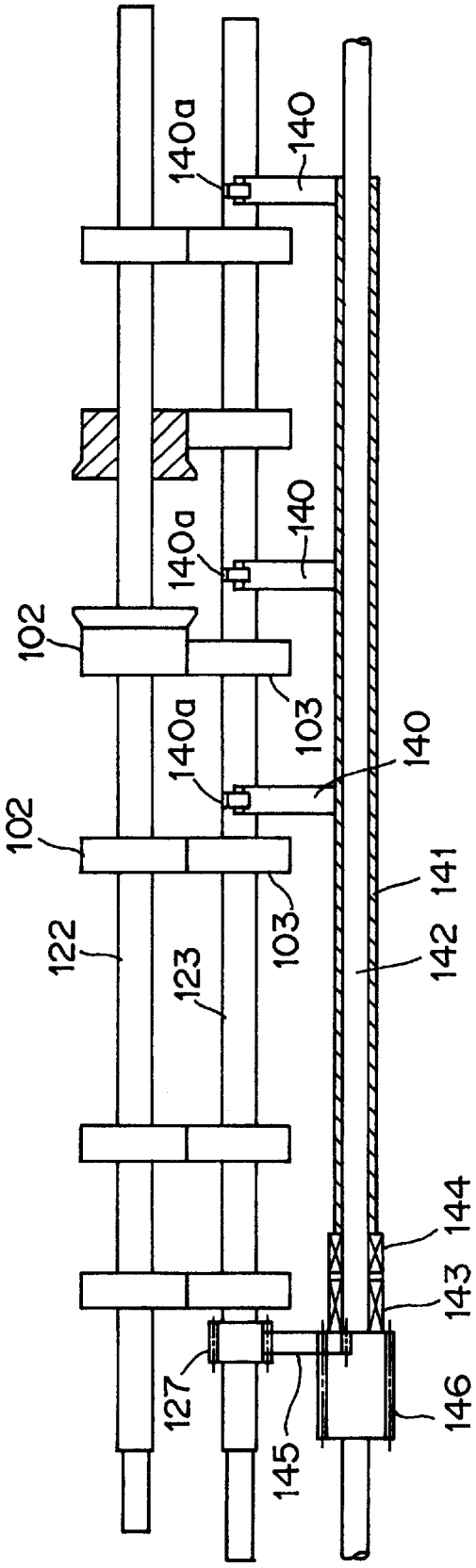

140a
140
140a
140
102
103
140a
140
102
103
141
122
123
142
144
143
127
145
146

FIG. 23a

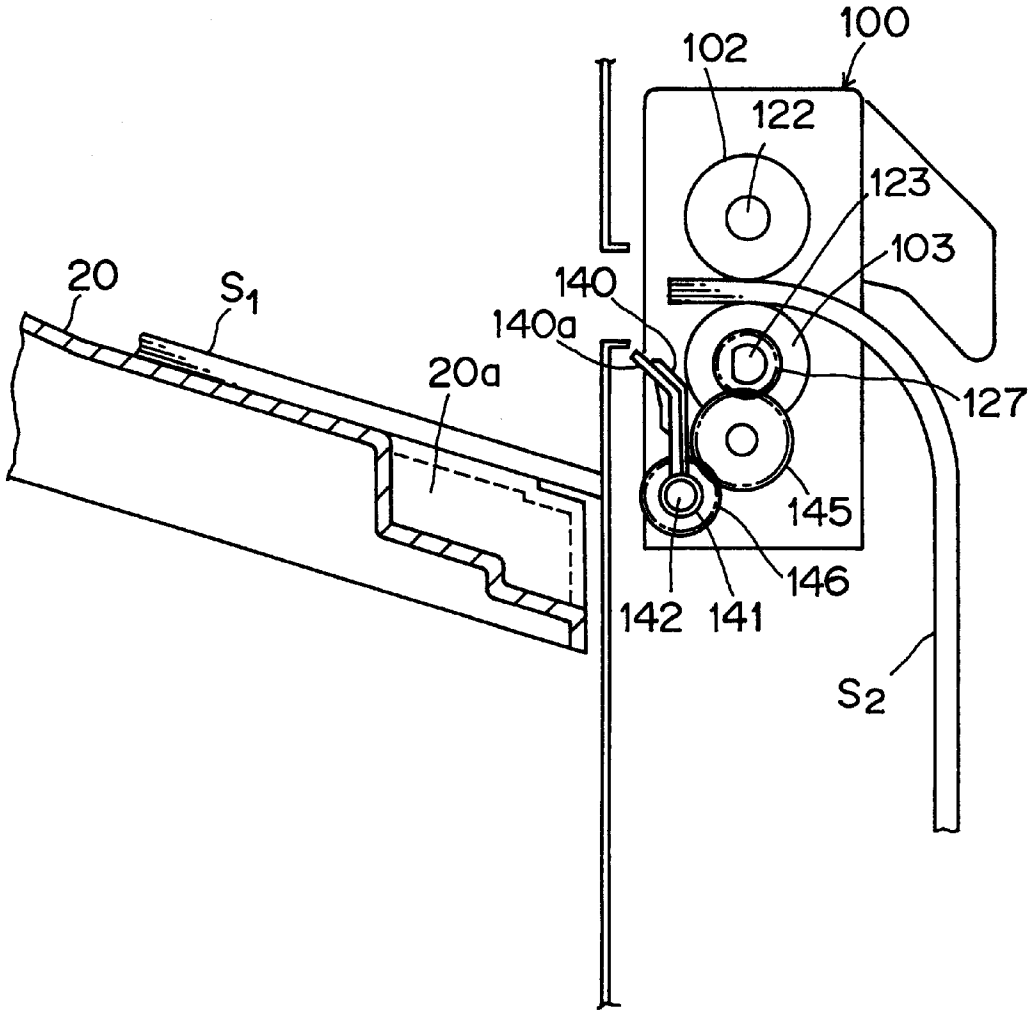


FIG. 23b

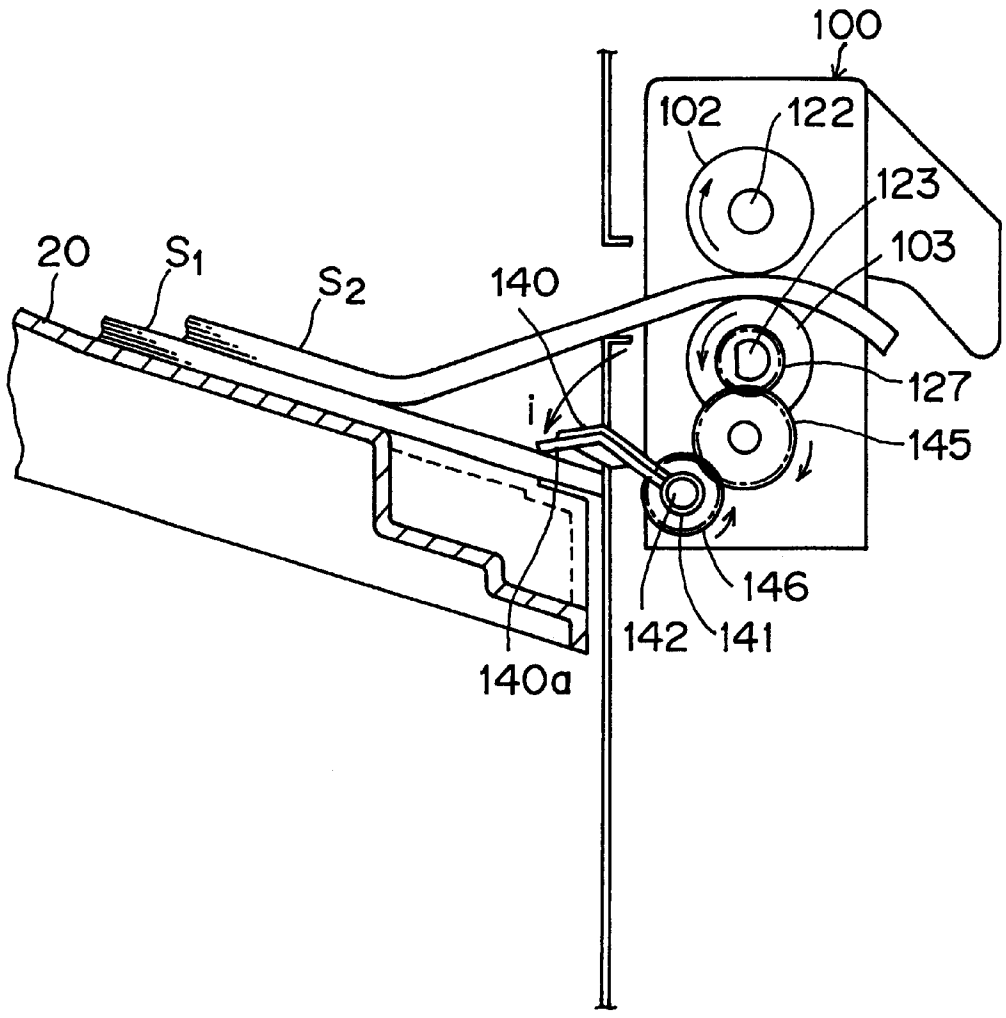


FIG. 23c

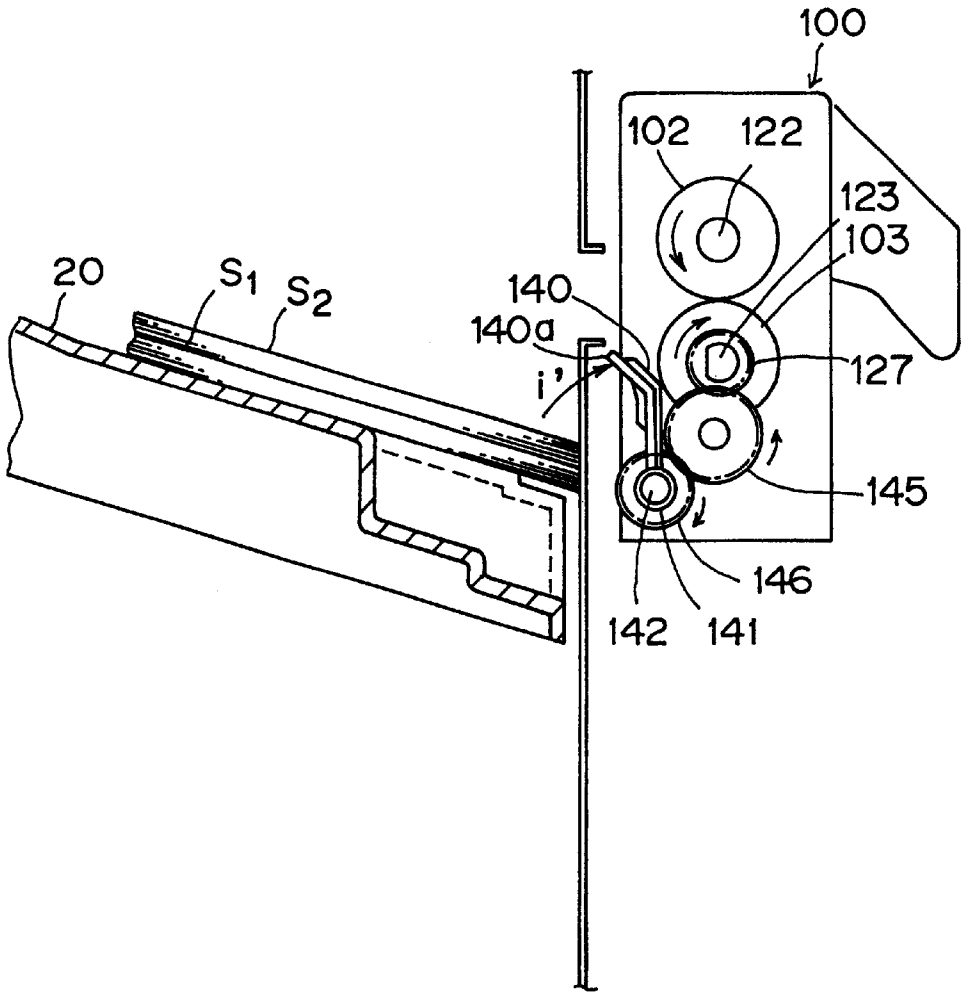


FIG. 24

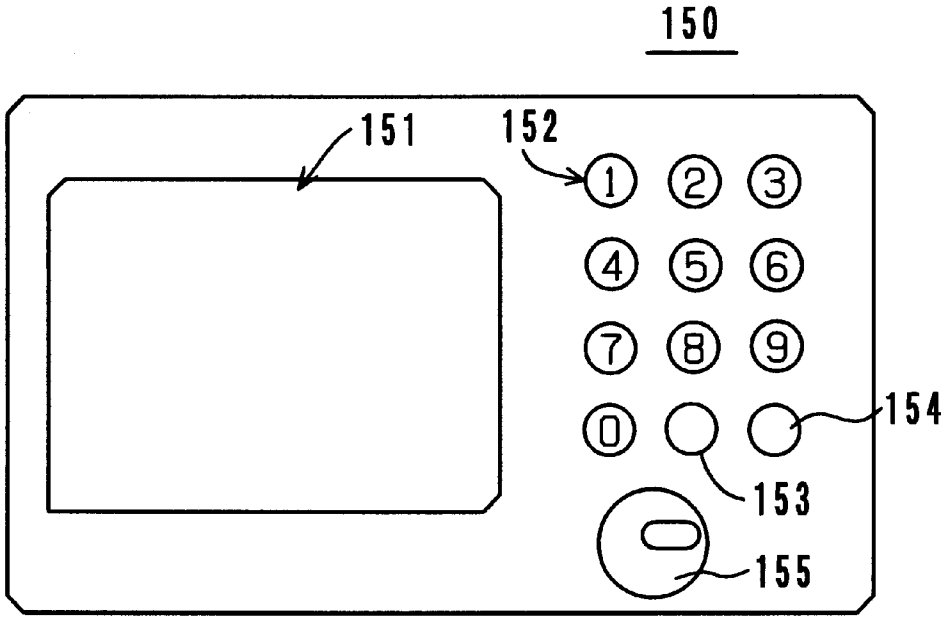


FIG. 25

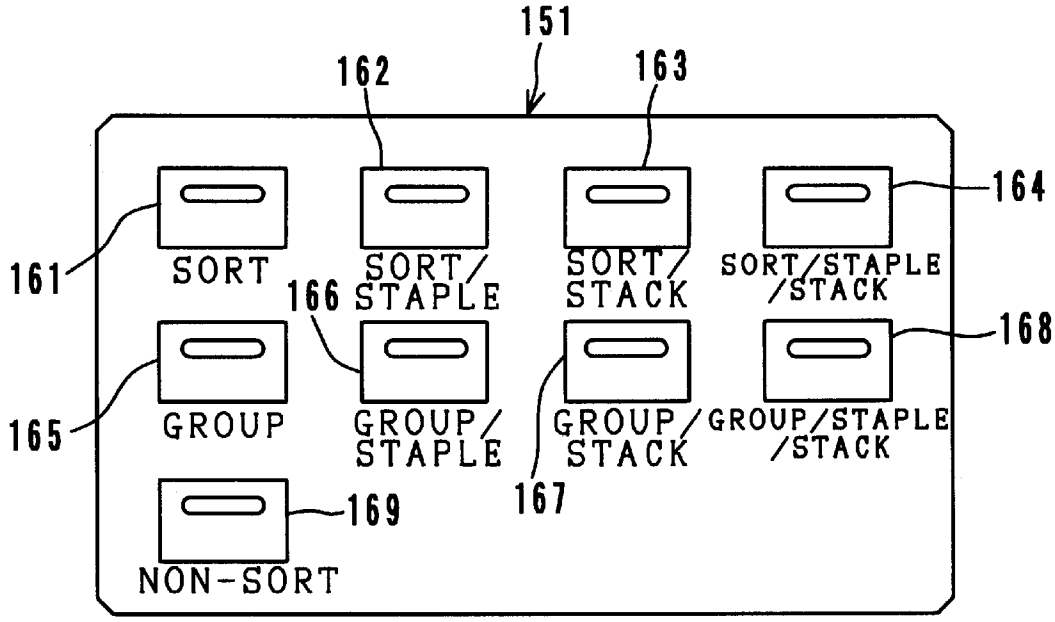

151
162
163
161
SORT
SORT/
STAPLE
SORT/
STACK
SORT/STAPLE
/STACK
164
166
168
165
GROUP
GROUP/
STAPLE
GROUP/
STACK
GROUP/STAPLE
/STACK
167
169
NON-SORT

FIG. 26

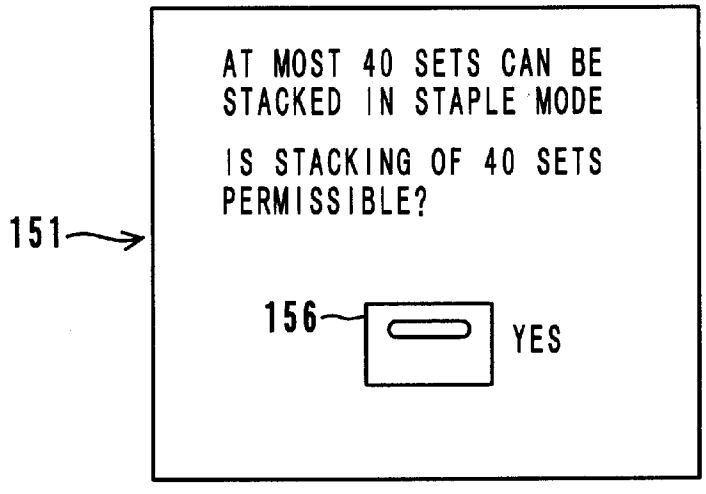

AT MOST 40 SETS CAN BE
STACKED IN STAPLE MODE
IS STACKING OF 40 SETS
PERMISSIBLE?
151
156
YES

FIG. 27

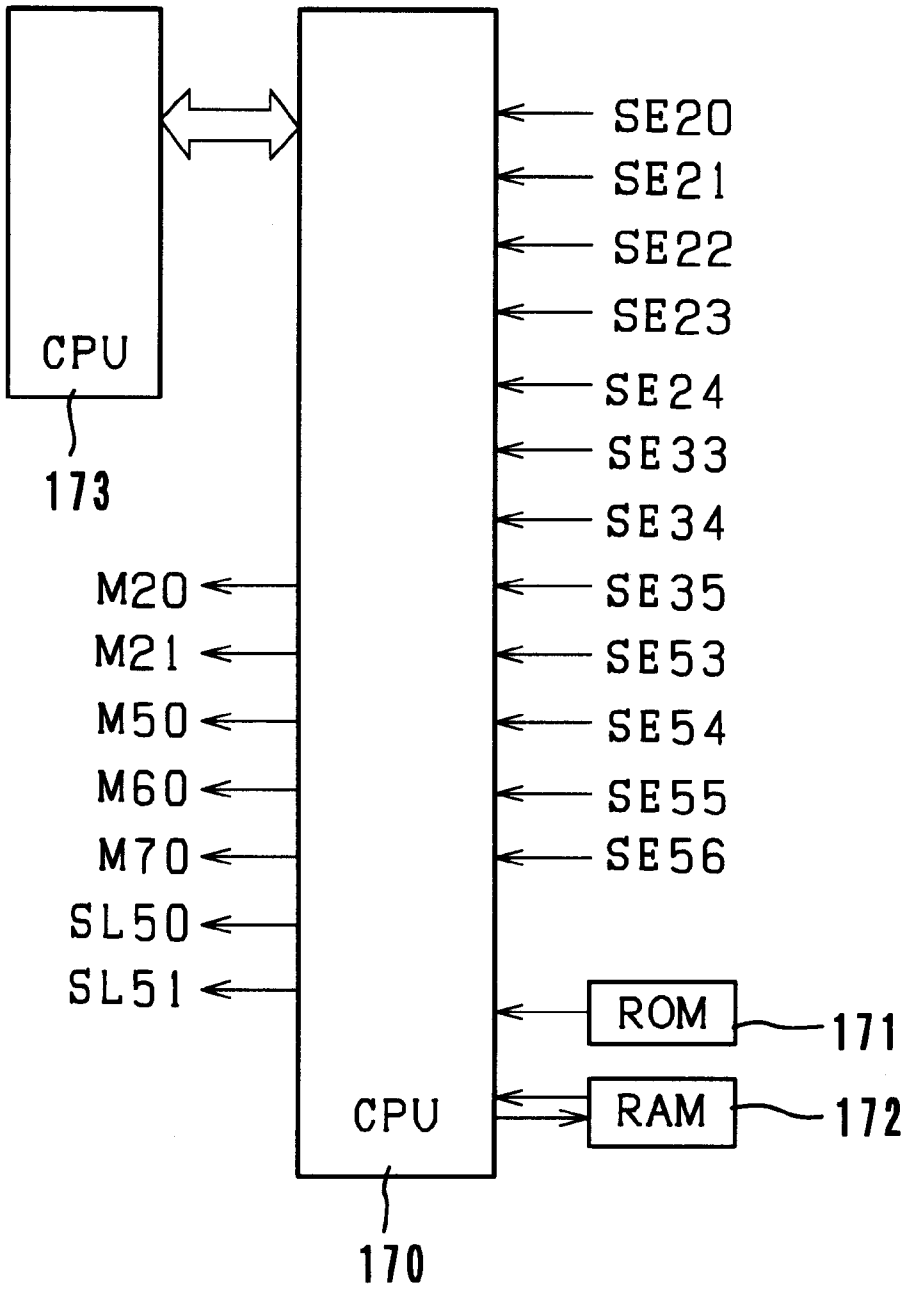

CPU
173
SE20
SE21
SE22
SE23
SE24
SE33
SE34
SE35
SE53
SE54
SE55
SE56
M20
M21
M50
M60
M70
SL50
SL51
ROM
171
RAM
172
CPU
170

FIG. 28

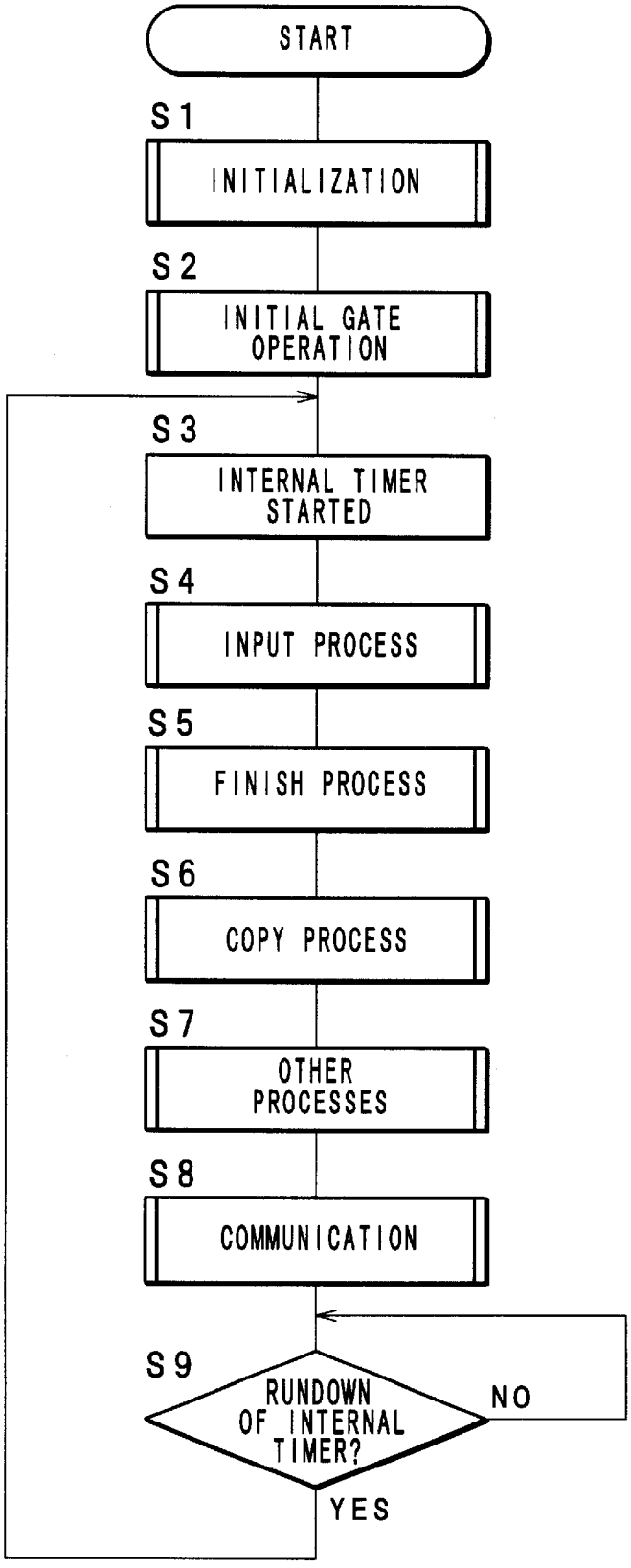

START
S1
INITIALIZATION
S2
INITIAL GATE OPERATION
S3
INTERNAL TIMER STARTED
S4
INPUT PROCESS
S5
FINISH PROCESS
S6
COPY PROCESS
S7
OTHER PROCESSES
S8
COMMUNICATION
S9
RUNDOWN OF INTERNAL TIMER?
NO
YES

FIG. 29

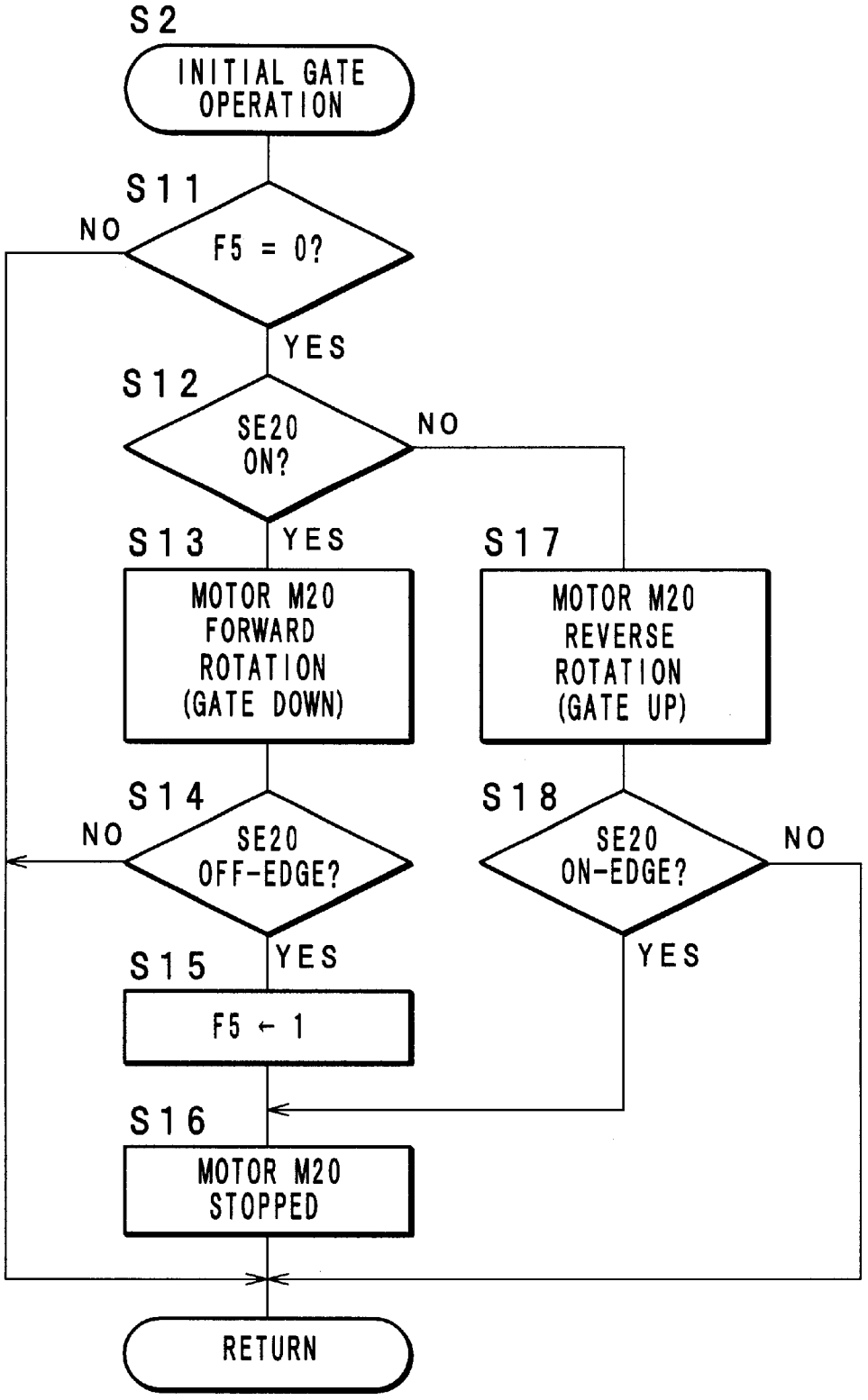

S2
INITIAL GATE OPERATION
S11
F5 = 0?
NO
YES
S12
SE20 ON?
NO
YES
S13
MOTOR M20 FORWARD ROTATION (GATE DOWN)
S17
MOTOR M20 REVERSE ROTATION (GATE UP)
S14
SE20 OFF-EDGE?
NO
S18
SE20 ON-EDGE?
NO
YES
S15
YES
F5 ← 1
S16
MOTOR M20 STOPPED
RETURN

FIG. 30

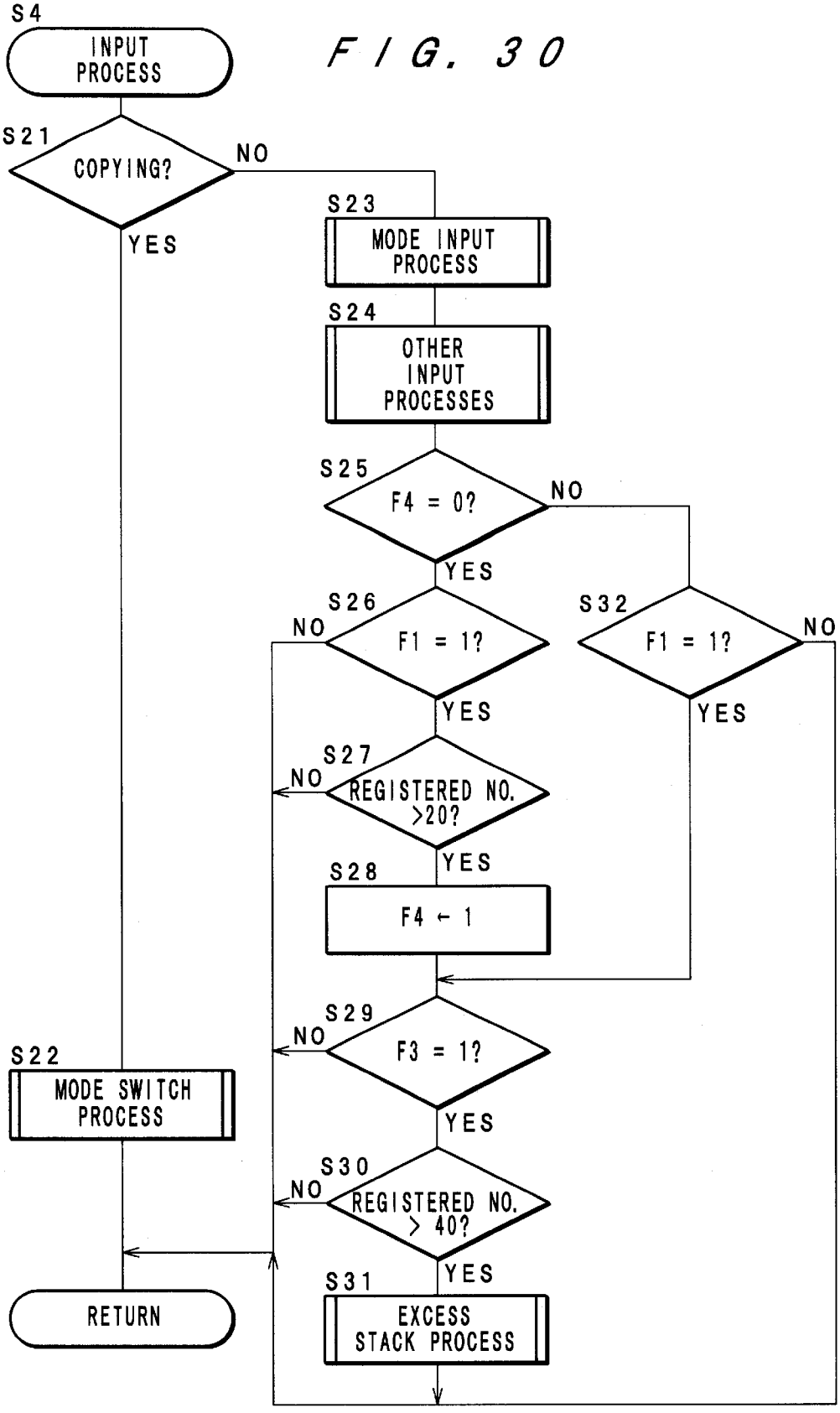
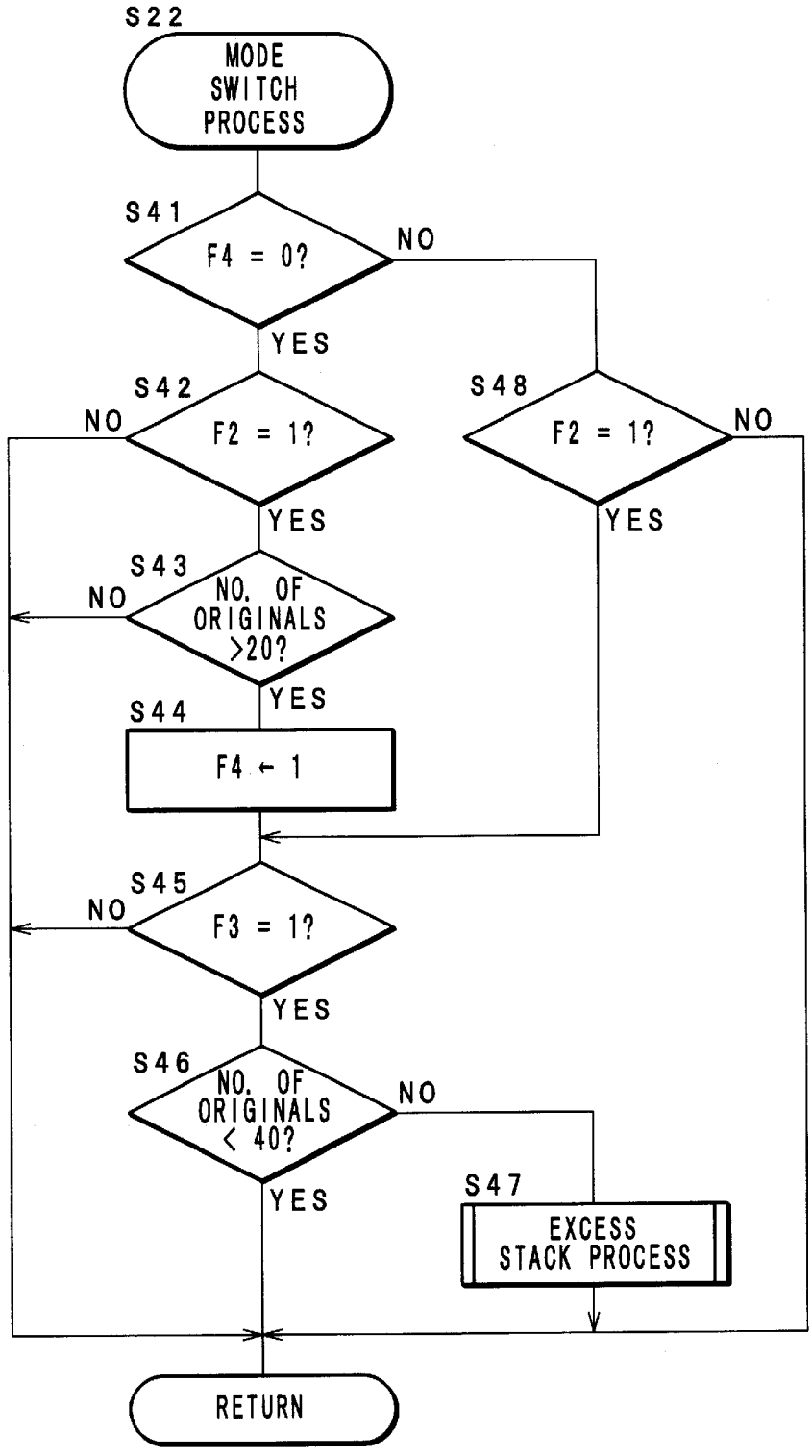

S4
INPUT PROCESS
S21
COPYING?
NO
YES
S23
MODE INPUT PROCESS
S24
OTHER INPUT PROCESSES
S25
F4 = 0?
NO
YES
S26
NO
F1 = 1?
YES
S27
NO
REGISTERED NO. >20?
YES
S28
F4 ← 1
S32
F1 = 1?
NO
YES
S29
NO
F3 = 1?
YES
S30
NO
REGISTERED NO. > 40?
YES
S31
EXCESS STACK PROCESS
S22
MODE SWITCH PROCESS
RETURN

FIG. 31


S22
MODE SWITCH PROCESS
S41
F4 = 0?
NO
YES
S42
F2 = 1?
NO
YES
S48
F2 = 1?
NO
YES
S43
NO. OF ORIGINALS >20?
NO
YES
S44
F4 ← 1
S45
F3 = 1?
NO
YES
S46
NO. OF ORIGINALS < 40?
NO
YES
S47
EXCESS STACK PROCESS
RETURN

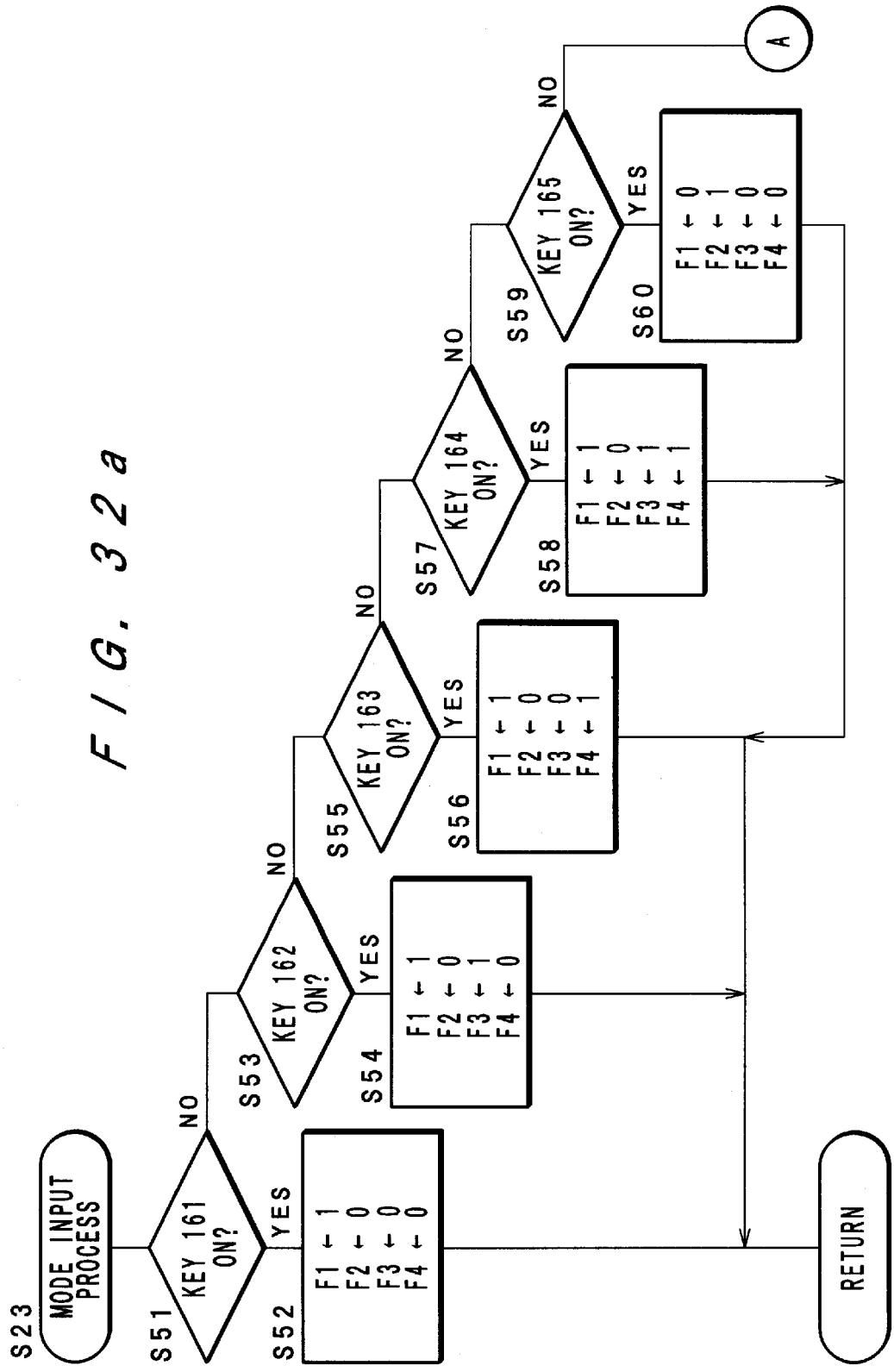

S23
MODE INPUT PROCESS
S51
KEY 161 ON?
NO
YES
S52
F1 ← 1
F2 ← 0
F3 ← 0
F4 ← 0
S53
KEY 162 ON?
NO
YES
S54
F1 ← 1
F2 ← 0
F3 ← 1
F4 ← 0
S55
KEY 163 ON?
NO
YES
S56
F1 ← 1
F2 ← 0
F3 ← 0
F4 ← 1
S57
KEY 164 ON?
NO
YES
S58
F1 ← 1
F2 ← 0
F3 ← 1
F4 ← 1
S59
KEY 165 ON?
NO
YES
S60
F1 ← 0
F2 ← 1
F3 ← 0
F4 ← 0
A
RETURN

FIG. 32a

FIG. 32b

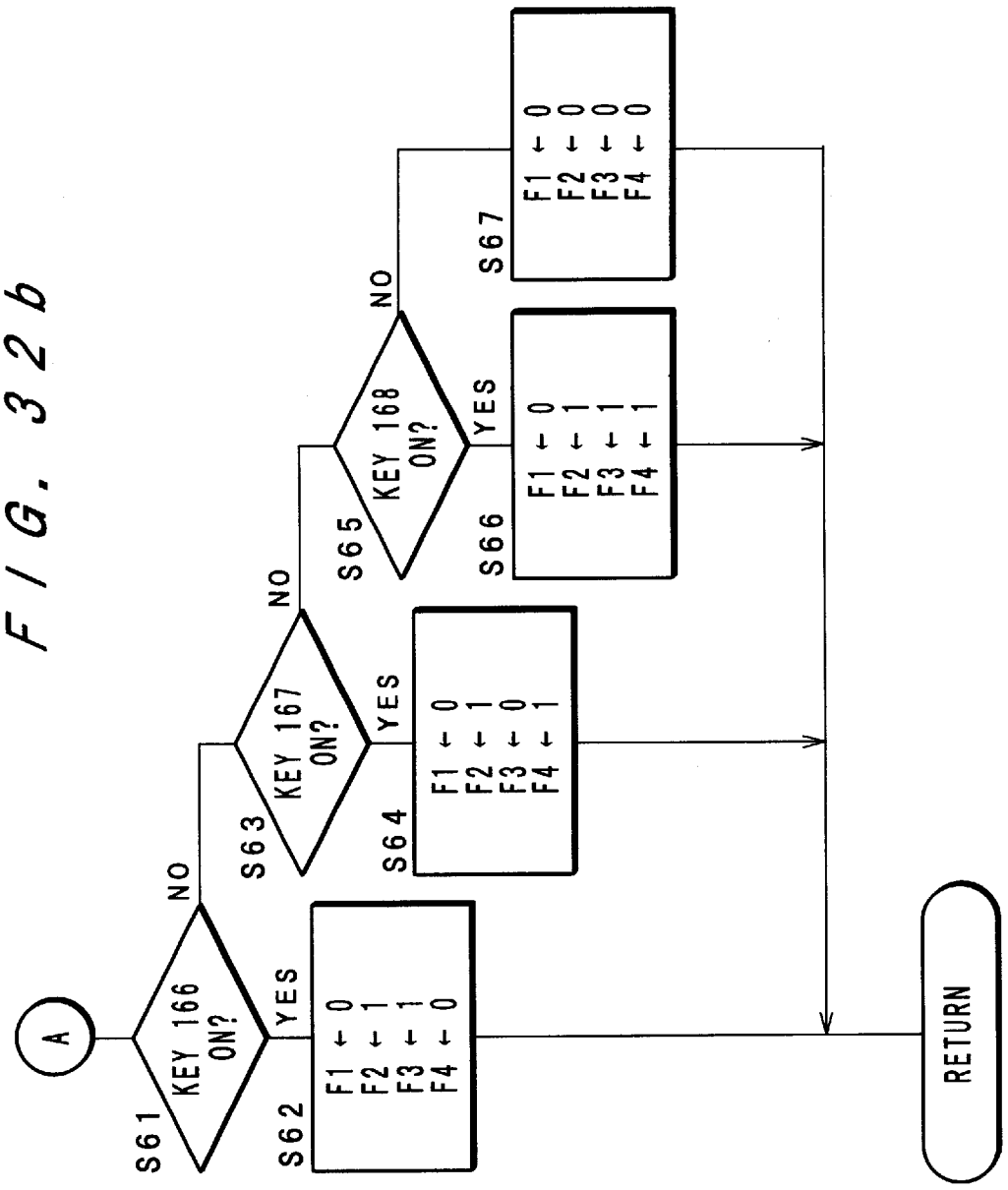

A
S61
KEY 166 ON?
YES
NO
S62
F1 ← 0
F2 ← 1
F3 ← 1
F4 ← 0
S63
KEY 167 ON?
YES
NO
S64
F1 ← 0
F2 ← 1
F3 ← 0
F4 ← 1
S65
KEY 168 ON?
YES
NO
S66
F1 ← 0
F2 ← 1
F3 ← 1
F4 ← 1
S67
F1 ← 0
F2 ← 0
F3 ← 0
F4 ← 0
RETURN

FIG. 33

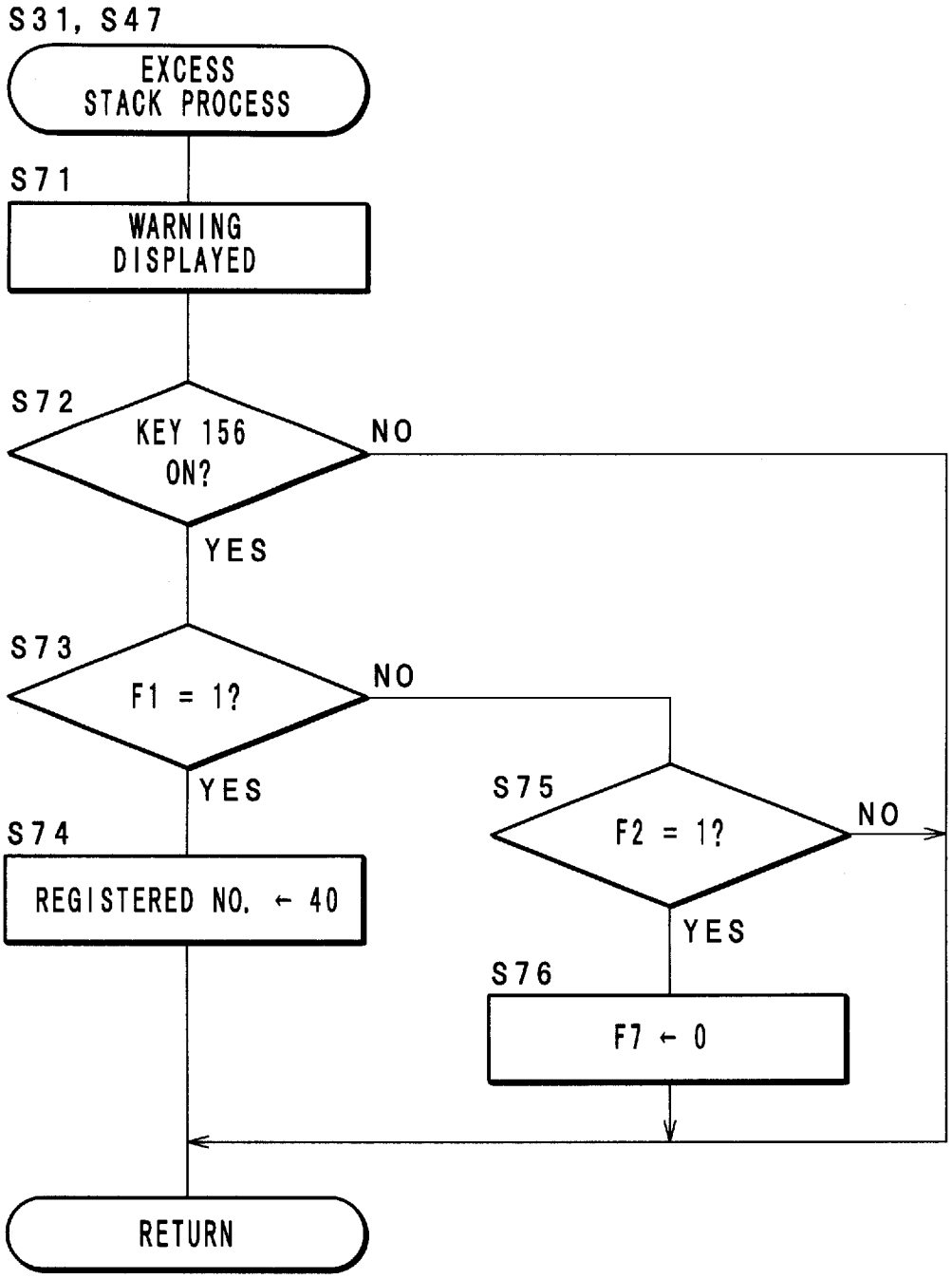

S31, S47
EXCESS STACK PROCESS
S71
WARNING DISPLAYED
S72
KEY 156 ON?
NO
YES
S73
F1 = 1?
NO
YES
S74
REGISTERED NO. ← 40
S75
F2 = 1?
NO
YES
S76
F7 ← 0
RETURN

FIG. 34

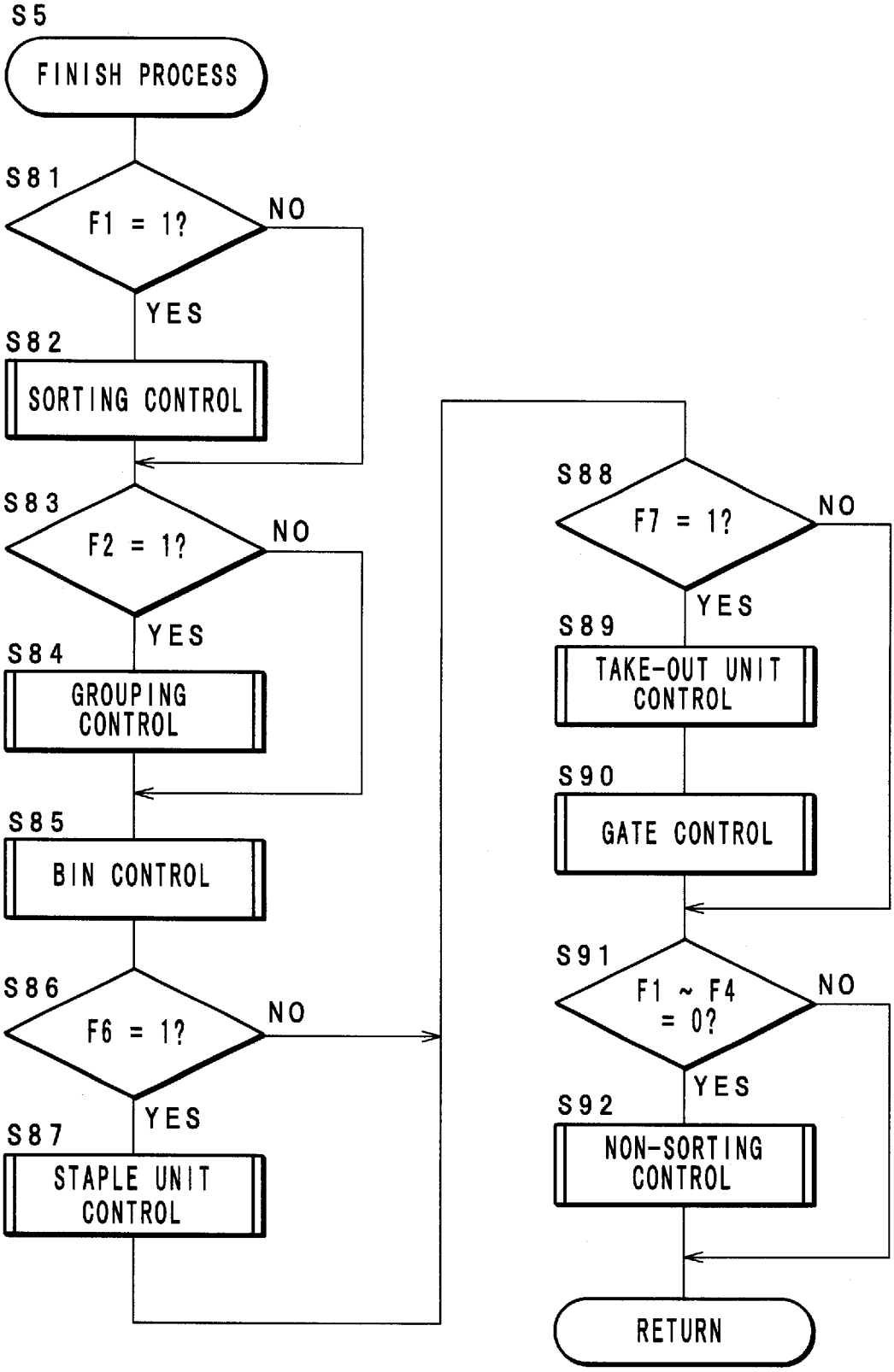

S5
FINISH PROCESS
S81
F1 = 1?
NO
YES
S82
SORTING CONTROL
S83
F2 = 1?
NO
YES
S84
GROUPING CONTROL
S85
BIN CONTROL
S86
F6 = 1?
NO
YES
S87
STAPLE UNIT CONTROL
S88
F7 = 1?
NO
YES
S89
TAKE-OUT UNIT CONTROL
S90
GATE CONTROL
S91
F1 ~ F4 = 0?
NO
YES
S92
NON-SORTING CONTROL
RETURN

FIG. 35a

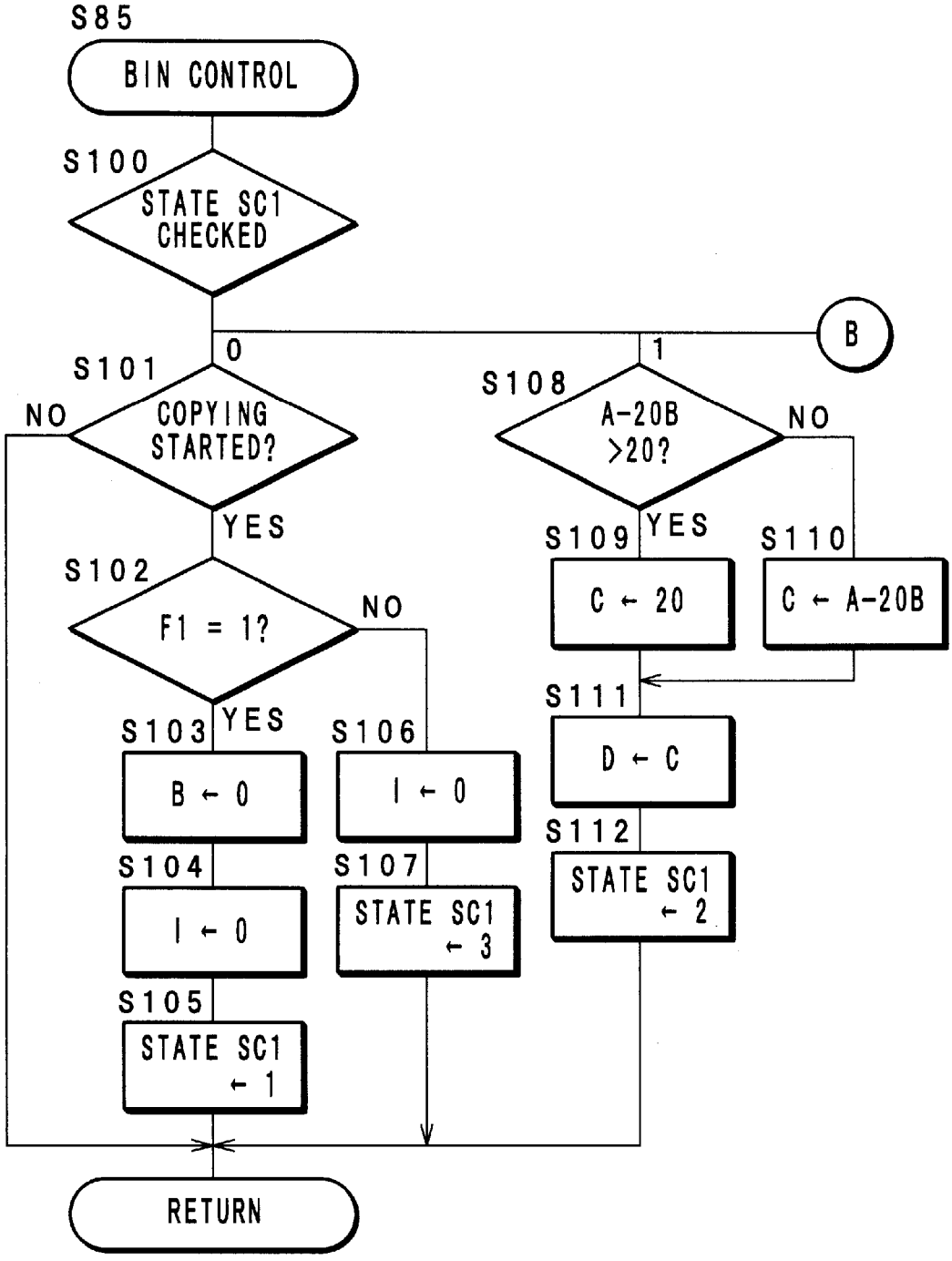

S85
BIN CONTROL
S100
STATE SC1 CHECKED
0
1
B
S101
COPYING STARTED?
NO
YES
S102
F1 = 1?
NO
YES
S103
B ← 0
S104
I ← 0
S105
STATE SC1 ← 1
S106
I ← 0
S107
STATE SC1 ← 3
S108
A-20B >20?
NO
YES
S109
C ← 20
S110
C ← A-20B
S111
D ← C
S112
STATE SC1 ← 2
RETURN

FIG. 35b

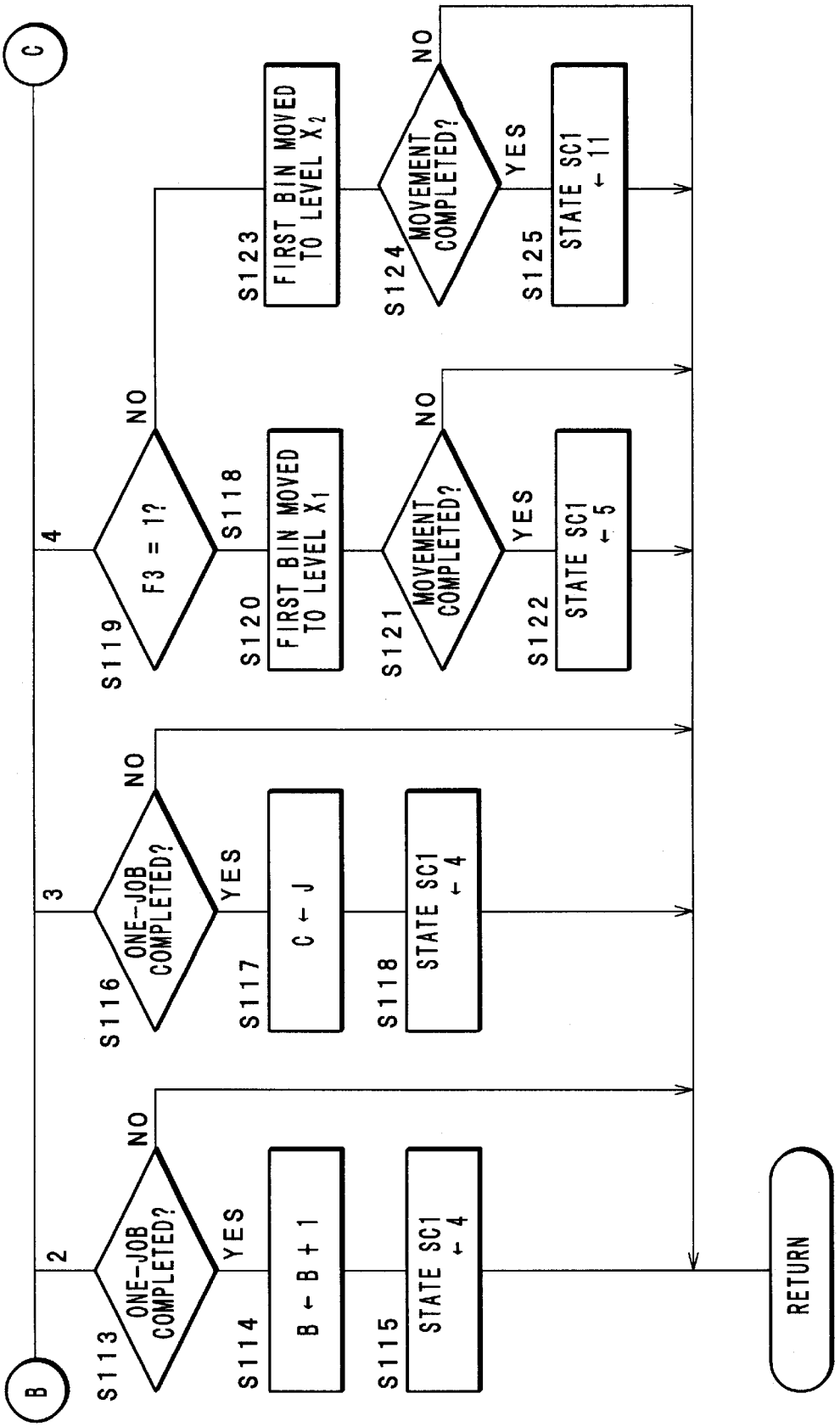

C
B
2
3
4
S113
ONE-JOB COMPLETED?
NO
YES
S114
B ← B + 1
S115
STATE SC1 ← 4
S116
ONE-JOB COMPLETED?
NO
YES
S117
C ← J
S118
STATE SC1 ← 4
S119
F3 = 1?
NO
S120
FIRST BIN MOVED TO LEVEL X1
S121
MOVEMENT COMPLETED?
NO
YES
S122
STATE SC1 ← 5
S123
FIRST BIN MOVED TO LEVEL X2
S124
MOVEMENT COMPLETED?
NO
YES
S125
STATE SC1 ← 11
RETURN

FIG. 35c

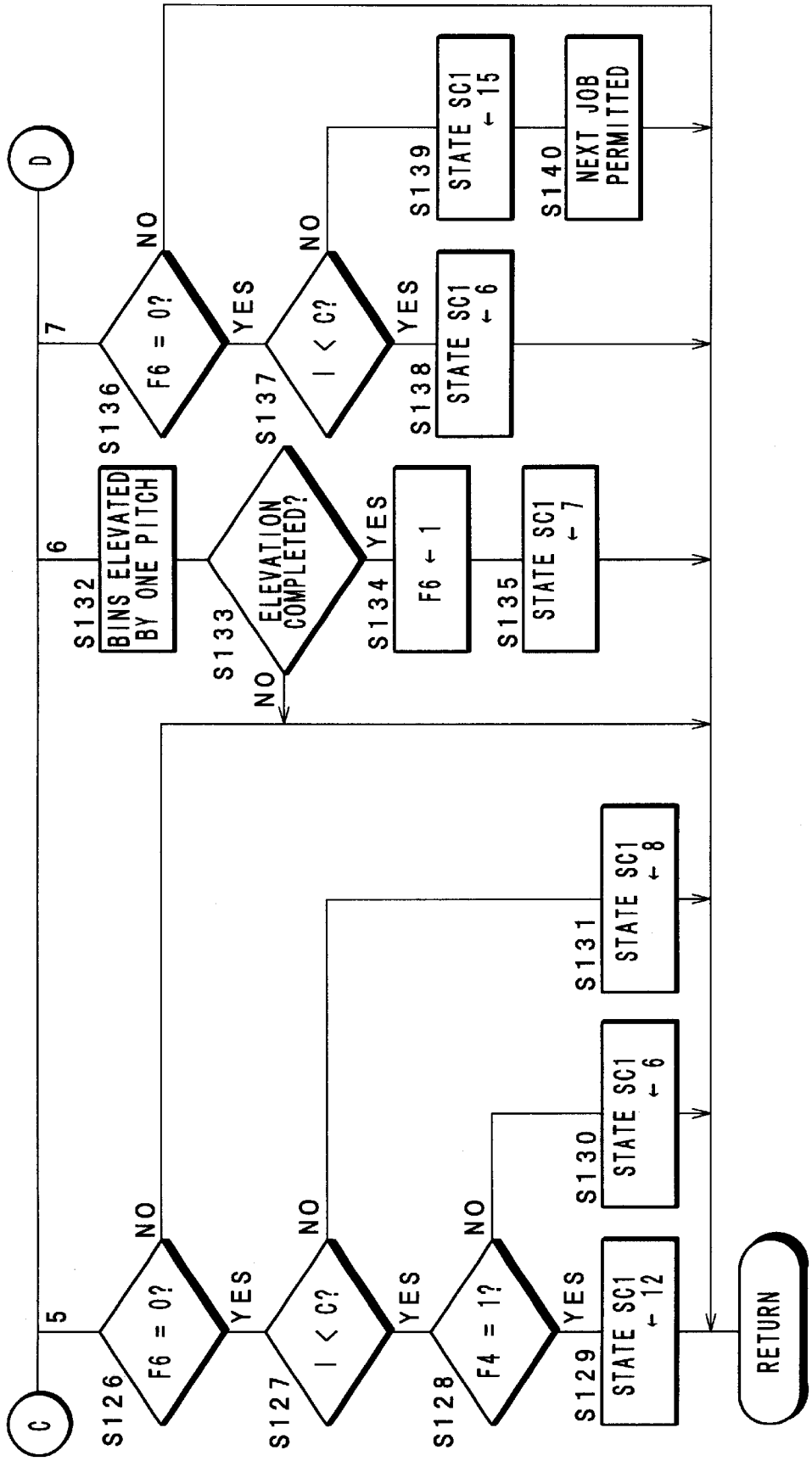

C
D
5
6
7
S126
F6 = 0?
NO
YES
S127
I < C?
NO
YES
S128
F4 = 1?
NO
YES
S129
STATE SC1 ← 12
S130
STATE SC1 ← 6
S131
STATE SC1 ← 8
RETURN
S132
BINS ELEVATED BY ONE PITCH
S133
ELEVATION COMPLETED?
NO
YES
S134
F6 ← 1
S135
STATE SC1 ← 7
S136
F6 = 0?
NO
YES
S137
I < C?
NO
YES
S138
STATE SC1 ← 6
S139
STATE SC1 ← 15
S140
NEXT JOB PERMITTED

FIG. 35d

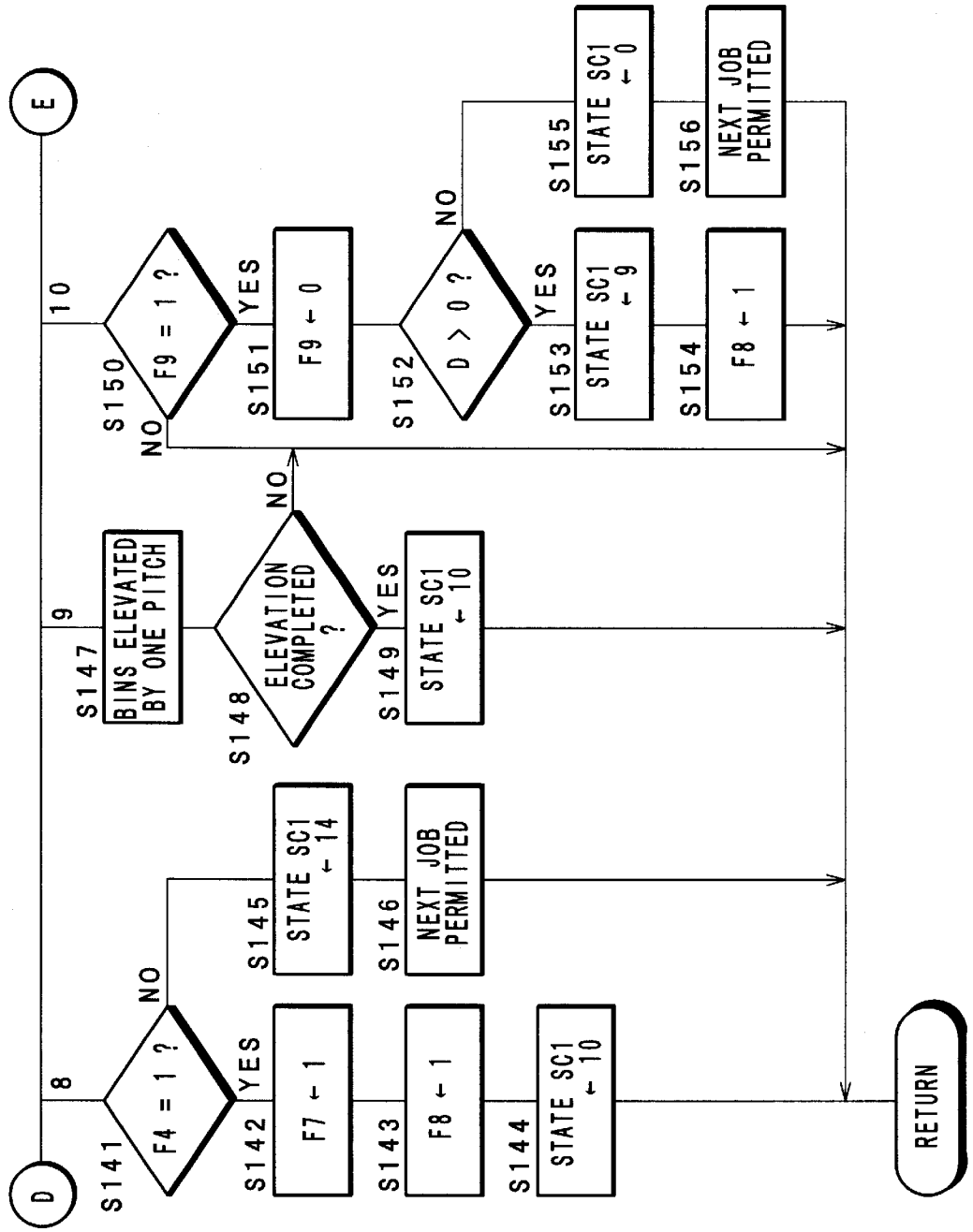

D
E
8
9
10
S141
F4 = 1 ?
YES
NO
S142
F7 ← 1
S143
F8 ← 1
S144
STATE SC1 ← 10
S145
STATE SC1 ← 14
S146
NEXT JOB PERMITTED
S147
BINS ELEVATED BY ONE PITCH
S148
ELEVATION COMPLETED ?
YES
NO
S149
STATE SC1 ← 10
S150
F9 = 1 ?
YES
NO
S151
F9 ← 0
S152
D > 0 ?
YES
NO
S153
STATE SC1 ← 9
S154
F8 ← 1
S155
STATE SC1 ← 0
S156
NEXT JOB PERMITTED
RETURN

FIG. 35e

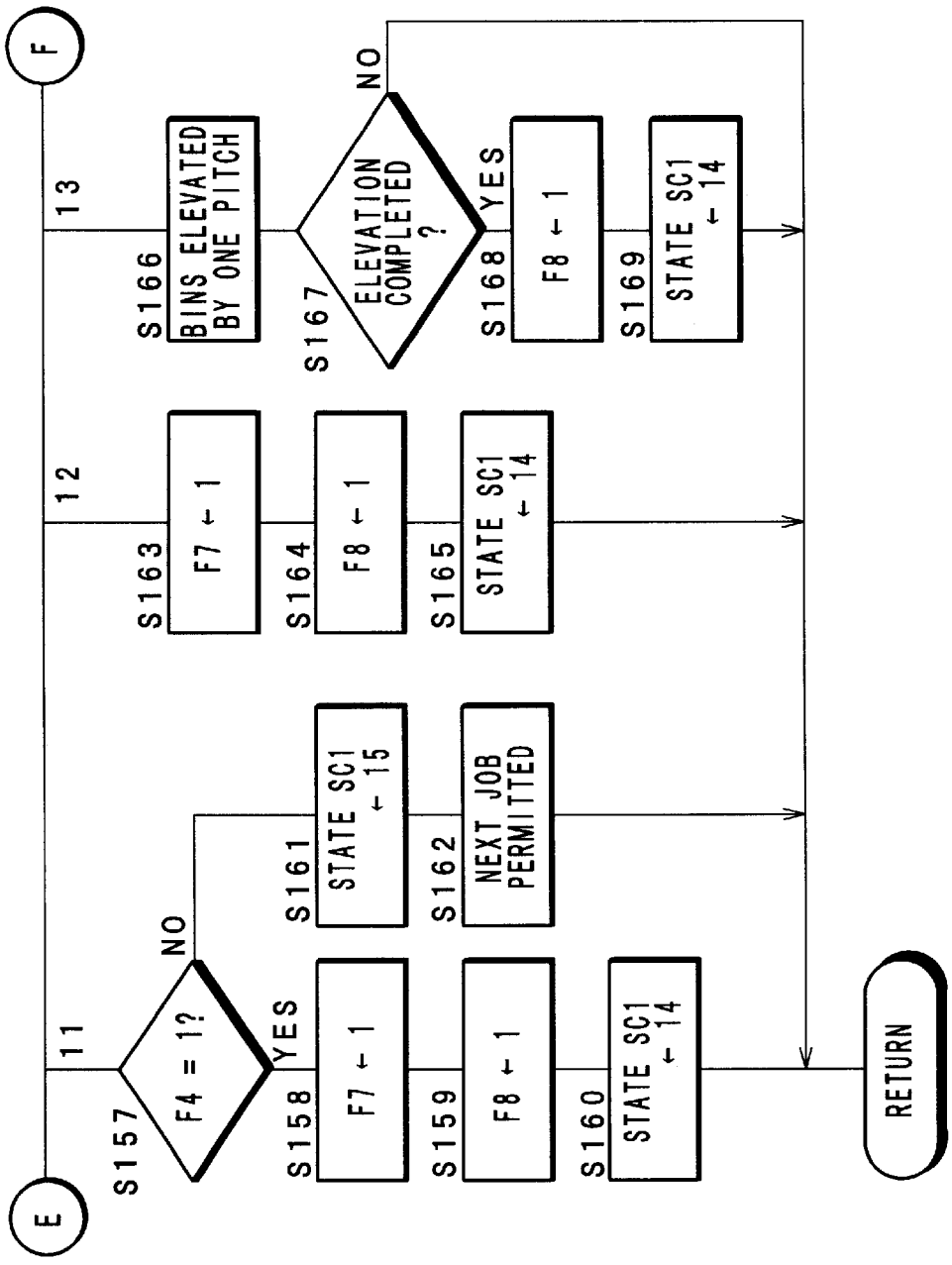

E
F
11
12
13
S157
F4 = 1?
NO
YES
S158
F7 ← 1
S159
F8 ← 1
S160
STATE SC1 ← 14
S161
STATE SC1 ← 15
S162
NEXT JOB PERMITTED
S163
F7 ← 1
S164
F8 ← 1
S165
STATE SC1 ← 14
S166
BINS ELEVATED BY ONE PITCH
S167
ELEVATION COMPLETED ?
NO
YES
S168
F8 ← 1
S169
STATE SC1 ← 14
RETURN

FIG. 35f

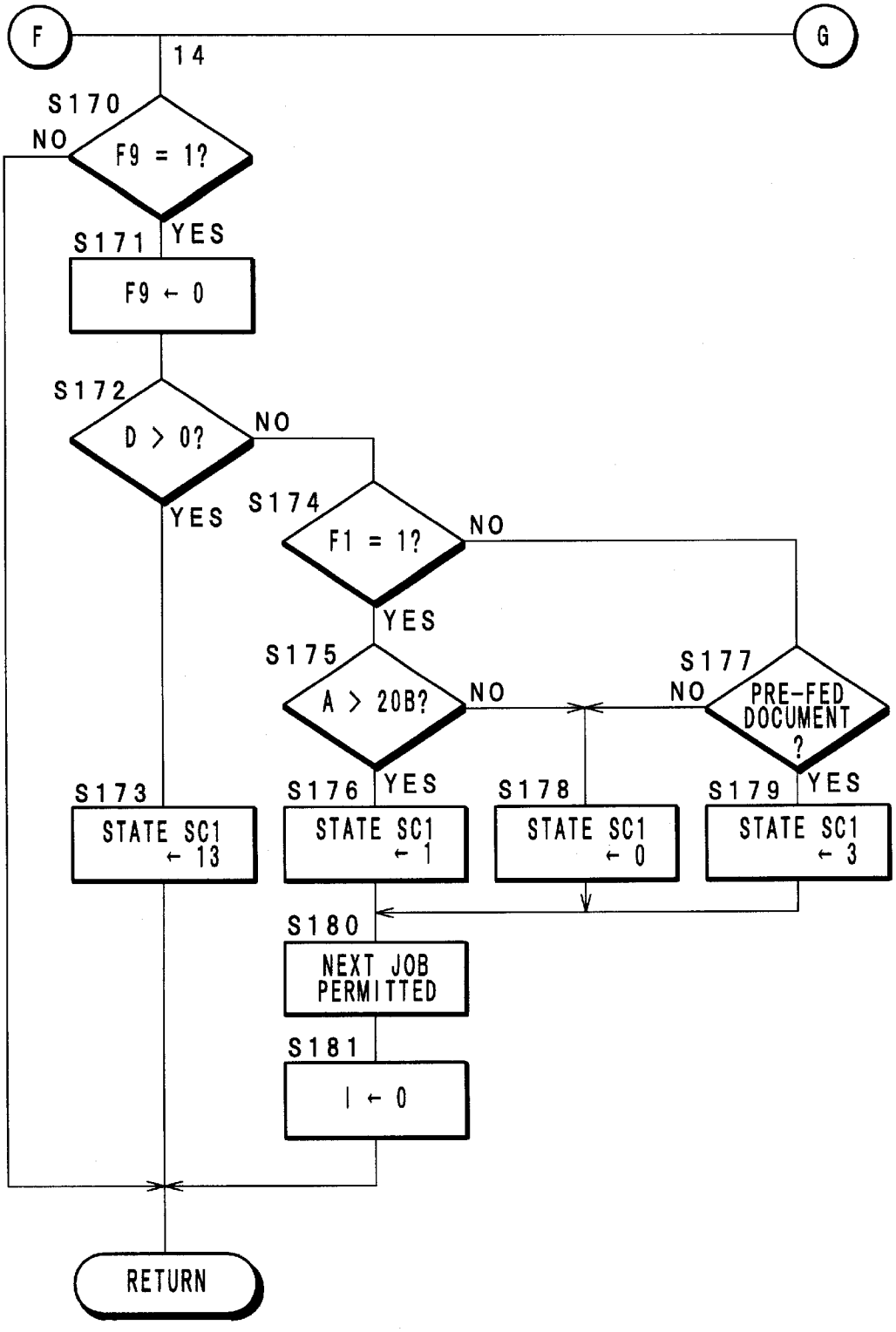

F
G
14
S170
F9 = 1?
NO
YES
S171
F9 ← 0
S172
D > 0?
NO
YES
S174
F1 = 1?
NO
YES
S175
A > 20B?
NO
S177
NO
PRE-FED DOCUMENT ?
S173
STATE SC1 ← 13
S176
YES
STATE SC1 ← 1
S178
STATE SC1 ← 0
S179
YES
STATE SC1 ← 3
S180
NEXT JOB PERMITTED
S181
I ← 0
RETURN

FIG. 35g

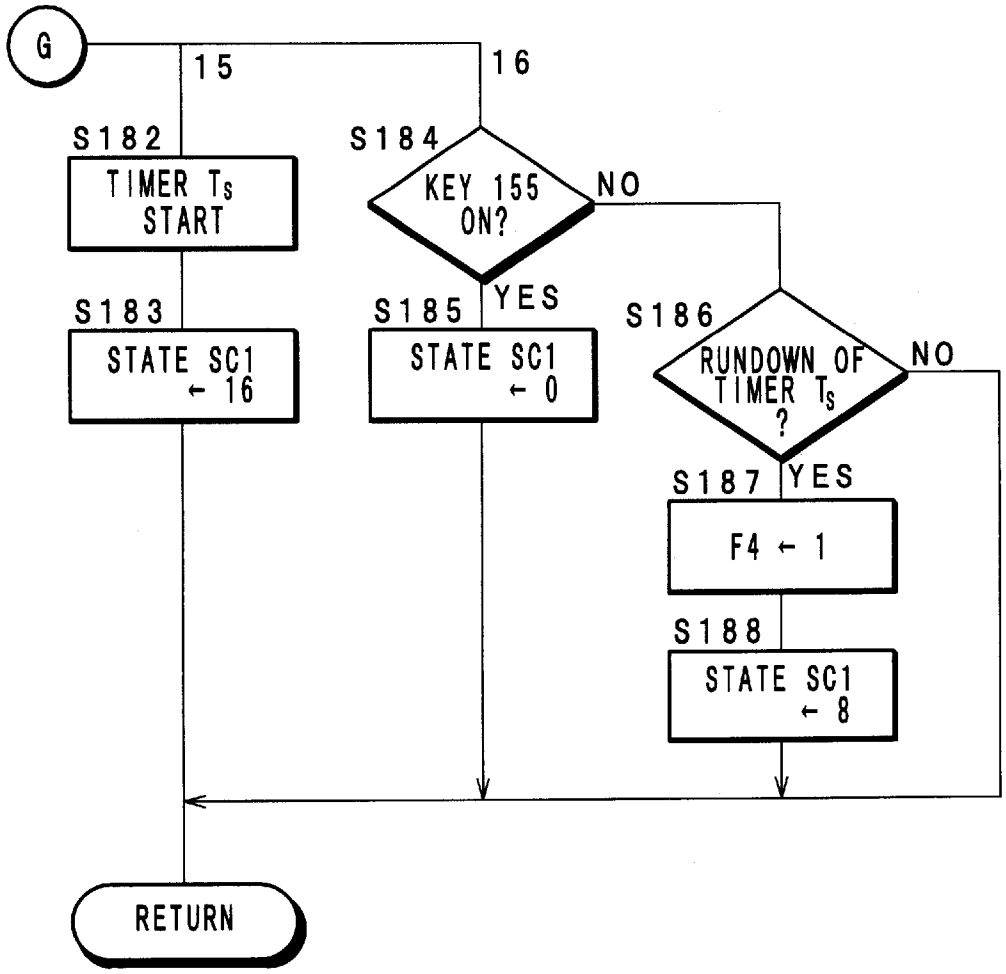

G
15
16
S182
TIMER Ts START
S183
STATE SC1 ← 16
S184
KEY 155 ON?
NO
YES
S185
STATE SC1 ← 0
S186
RUNDOWN OF TIMER Ts ?
NO
YES
S187
F4 ← 1
S188
STATE SC1 ← 8
RETURN

FIG. 36a

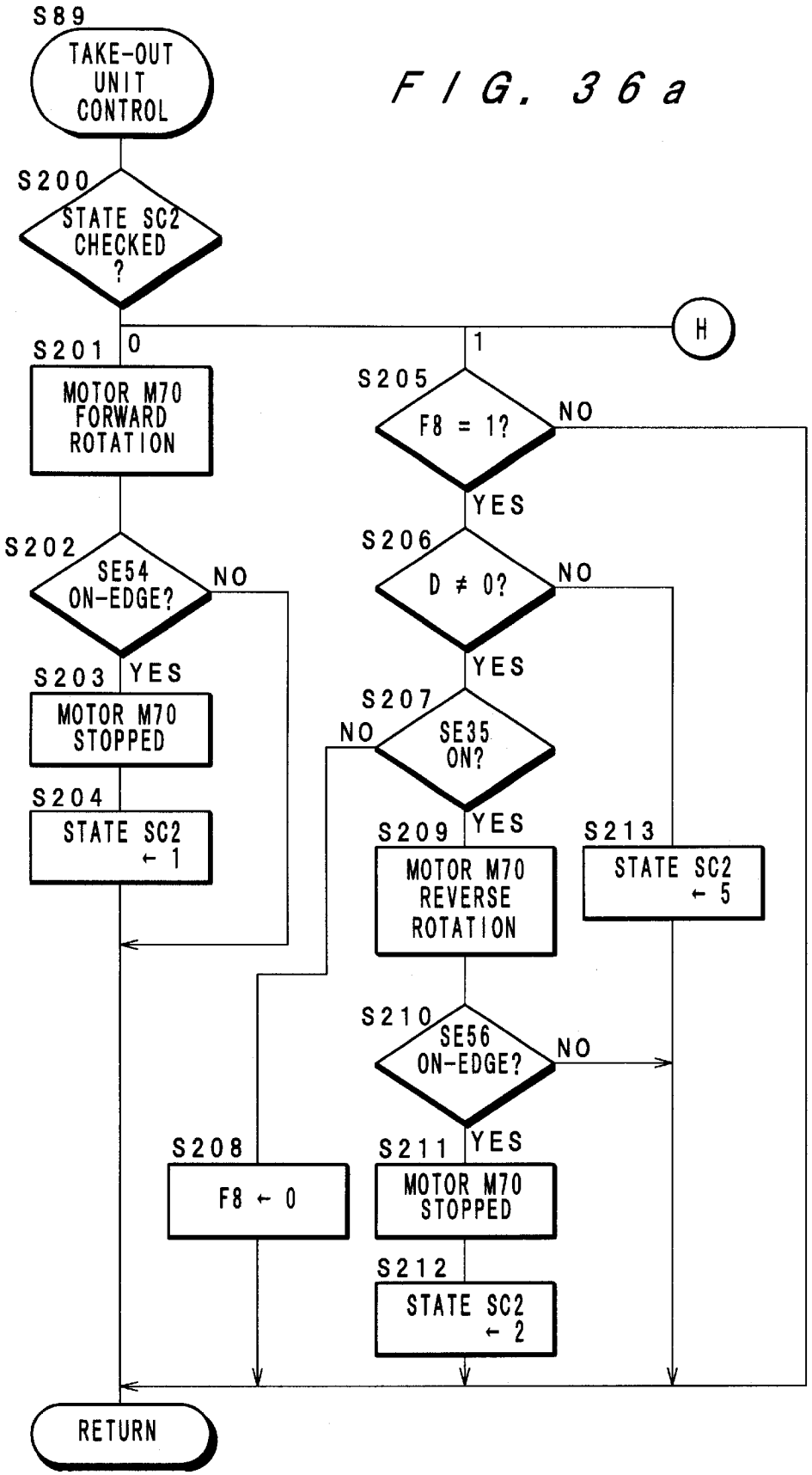
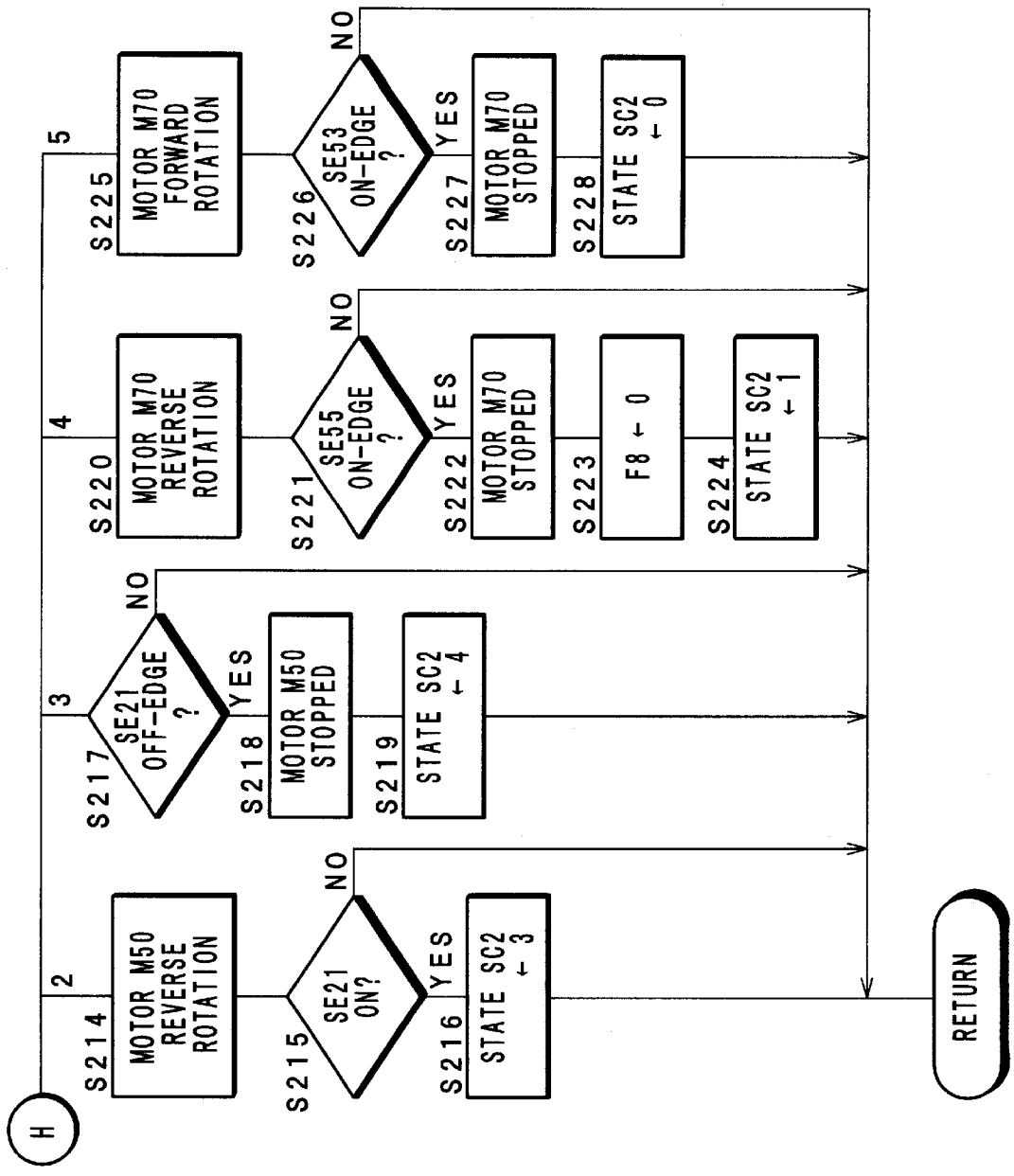
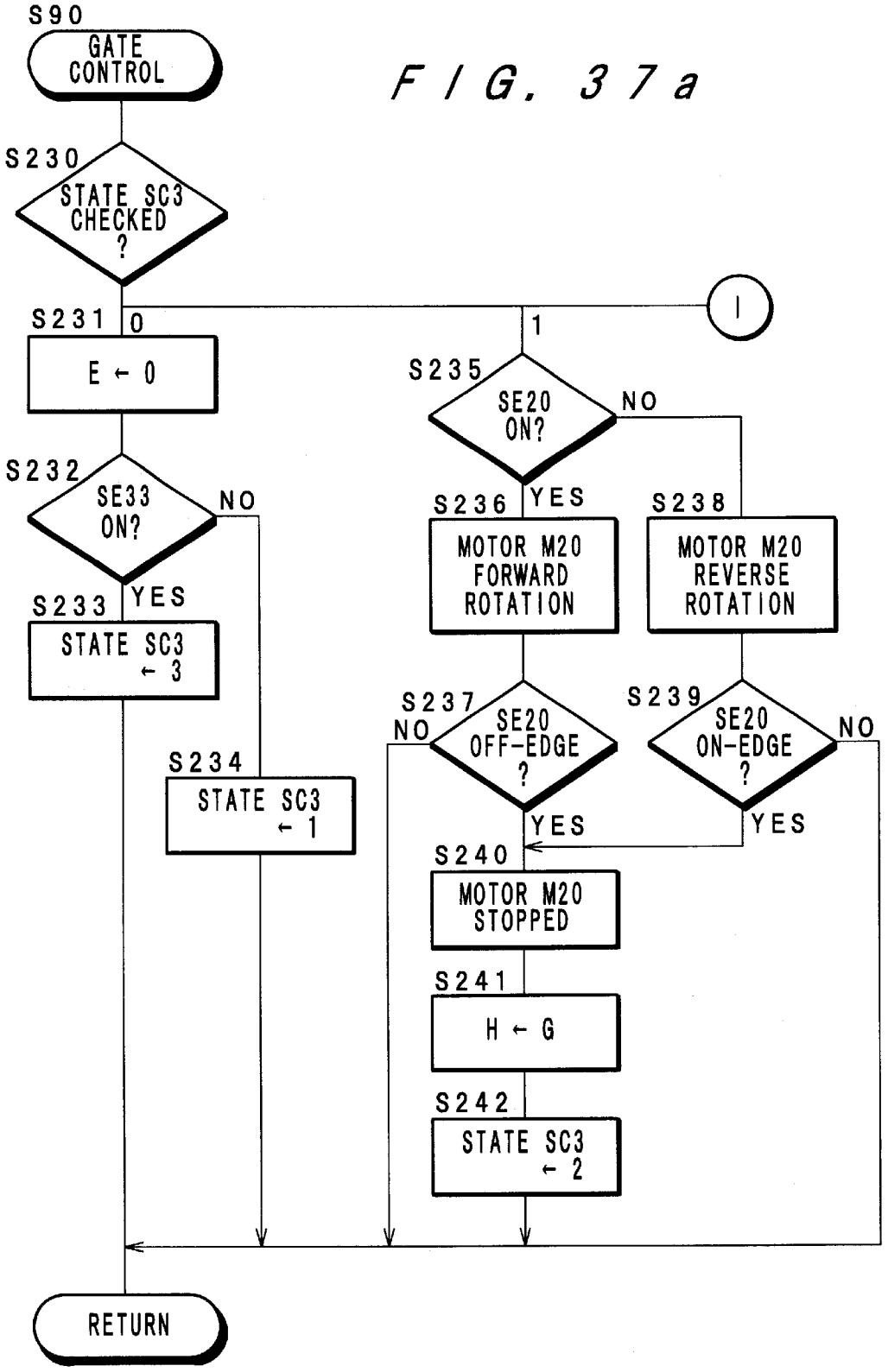

S89
TAKE-OUT UNIT CONTROL
S200
STATE SC2 CHECKED ?
H
0
1
S201
MOTOR M70 FORWARD ROTATION
S202
SE54 ON-EDGE?
NO
YES
S203
MOTOR M70 STOPPED
S204
STATE SC2 ← 1
S205
F8 = 1?
NO
YES
S206
D ≠ 0?
NO
YES
S207
SE35 ON?
NO
YES
S208
F8 ← 0
S209
MOTOR M70 REVERSE ROTATION
S210
SE56 ON-EDGE?
NO
YES
S211
MOTOR M70 STOPPED
S212
STATE SC2 ← 2
S213
STATE SC2 ← 5
RETURN

FIG. 36b


H
2
S214
MOTOR M50 REVERSE ROTATION
S215
SE21 ON?
NO
YES
S216
STATE SC2 ← 3
3
S217
SE21 OFF-EDGE ?
NO
YES
S218
MOTOR M50 STOPPED
S219
STATE SC2 ← 4
4
S220
MOTOR M70 REVERSE ROTATION
S221
SE55 ON-EDGE ?
NO
YES
S222
MOTOR M70 STOPPED
S223
F8 ← 0
S224
STATE SC2 ← 1
5
S225
MOTOR M70 FORWARD ROTATION
S226
SE53 ON-EDGE ?
NO
YES
S227
MOTOR M70 STOPPED
S228
STATE SC2 ← 0
RETURN


S90
GATE CONTROL
S230
STATE SC3 CHECKED ?
S231
0
E ← 0
S232
SE33 ON?
NO
YES
S233
STATE SC3 ← 3
S234
STATE SC3 ← 1
RETURN
1
S235
SE20 ON?
NO
YES
S236
MOTOR M20 FORWARD ROTATION
S238
MOTOR M20 REVERSE ROTATION
S237
SE20 OFF-EDGE ?
NO
YES
S239
SE20 ON-EDGE ?
NO
YES
S240
MOTOR M20 STOPPED
S241
H ← G
S242
STATE SC3 ← 2

F I G. 37a

FIG. 37b

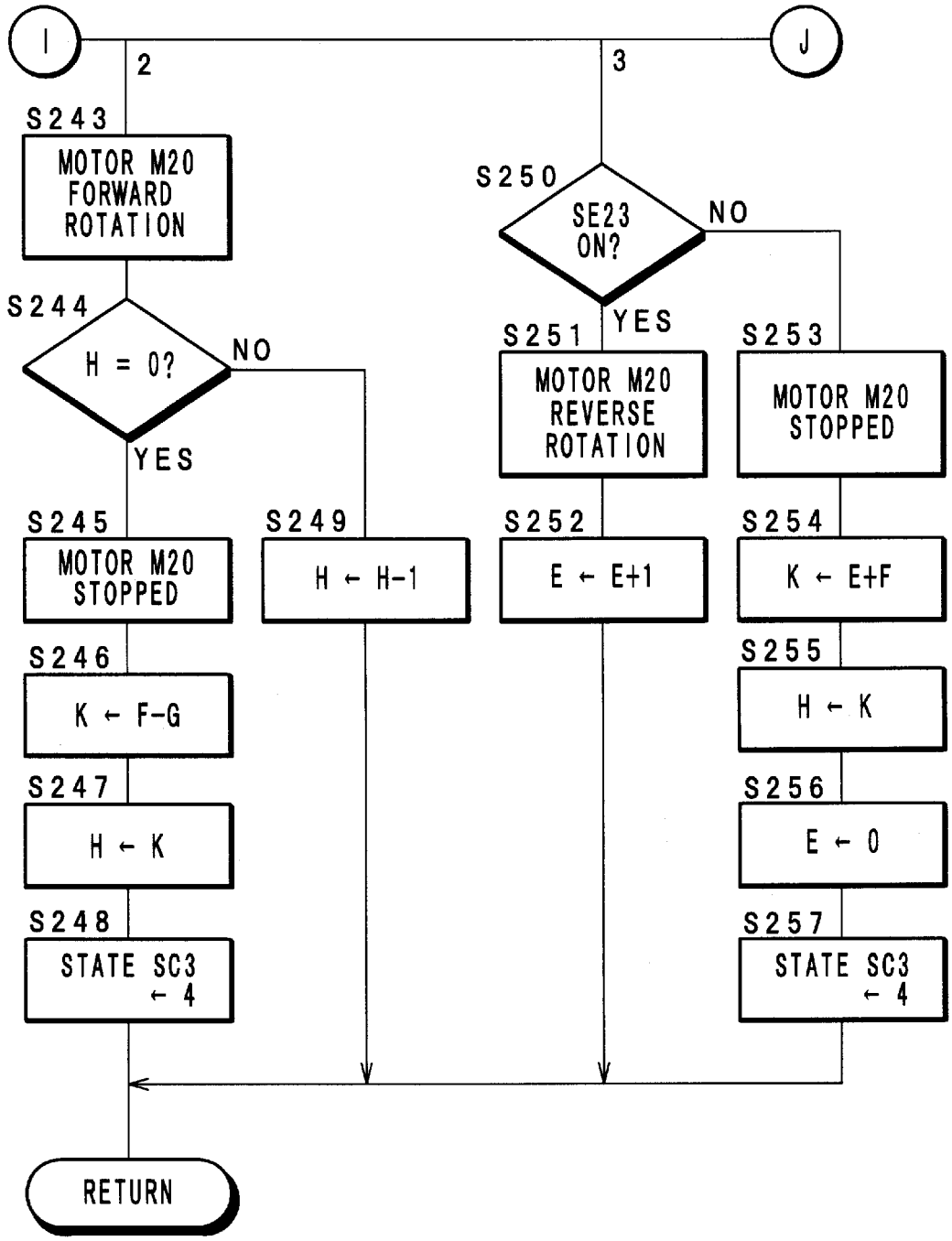

I
J
2
3
S243
MOTOR M20 FORWARD ROTATION
S244
H = 0?
NO
YES
S245
MOTOR M20 STOPPED
S246
K ← F-G
S247
H ← K
S248
STATE SC3 ← 4
S249
H ← H-1
S250
SE23 ON?
NO
YES
S251
MOTOR M20 REVERSE ROTATION
S252
E ← E+1
S253
MOTOR M20 STOPPED
S254
K ← E+F
S255
H ← K
S256
E ← 0
S257
STATE SC3 ← 4
RETURN

FIG. 37c

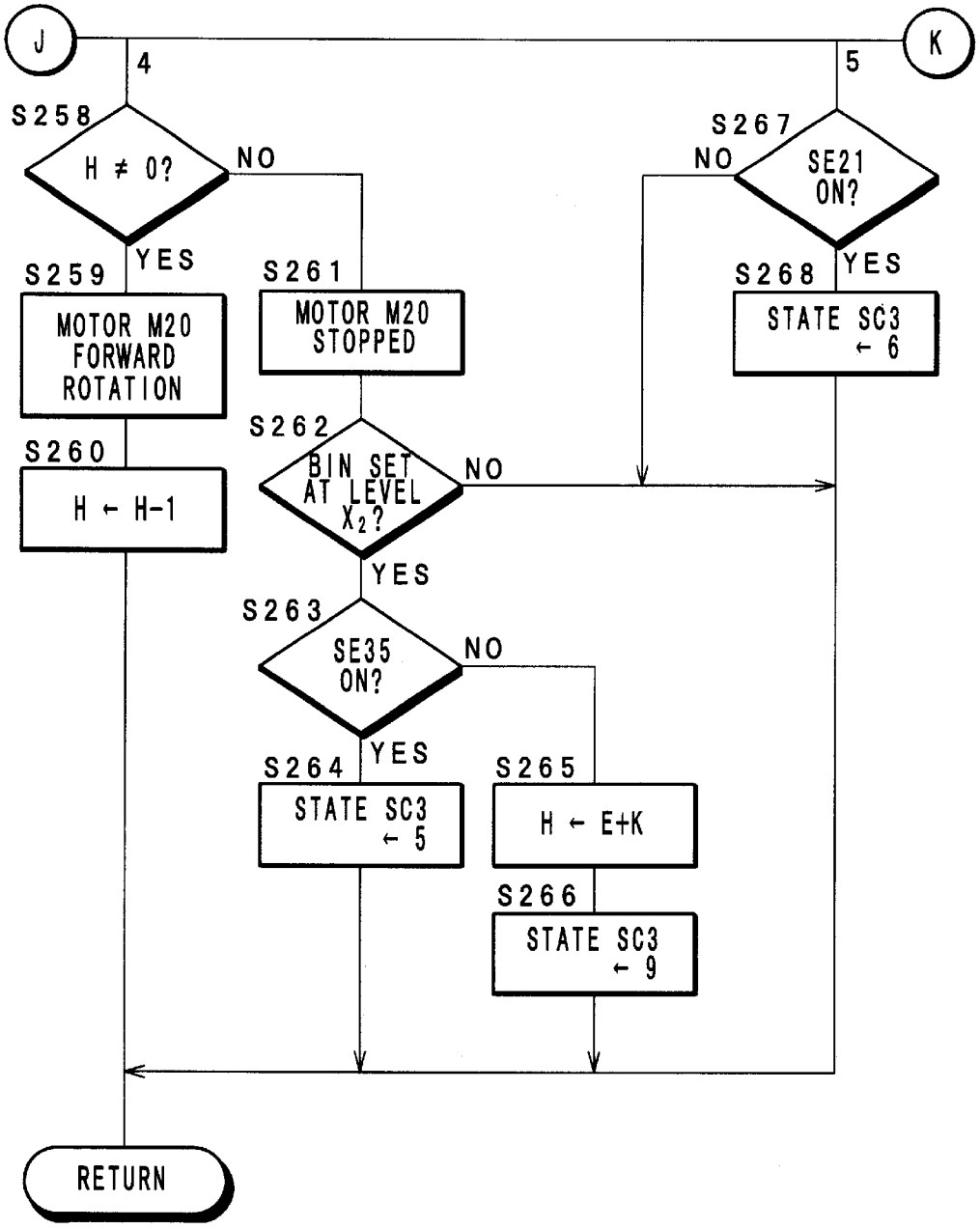

J
K
4
5
S258
H ≠ 0?
NO
YES
S259
MOTOR M20 FORWARD ROTATION
S260
H ← H-1
S261
MOTOR M20 STOPPED
S262
BIN SET AT LEVEL X2?
NO
YES
S263
SE35 ON?
NO
YES
S264
STATE SC3 ← 5
S265
H ← E+K
S266
STATE SC3 ← 9
S267
NO
SE21 ON?
YES
S268
STATE SC3 ← 6
RETURN

FIG. 37d

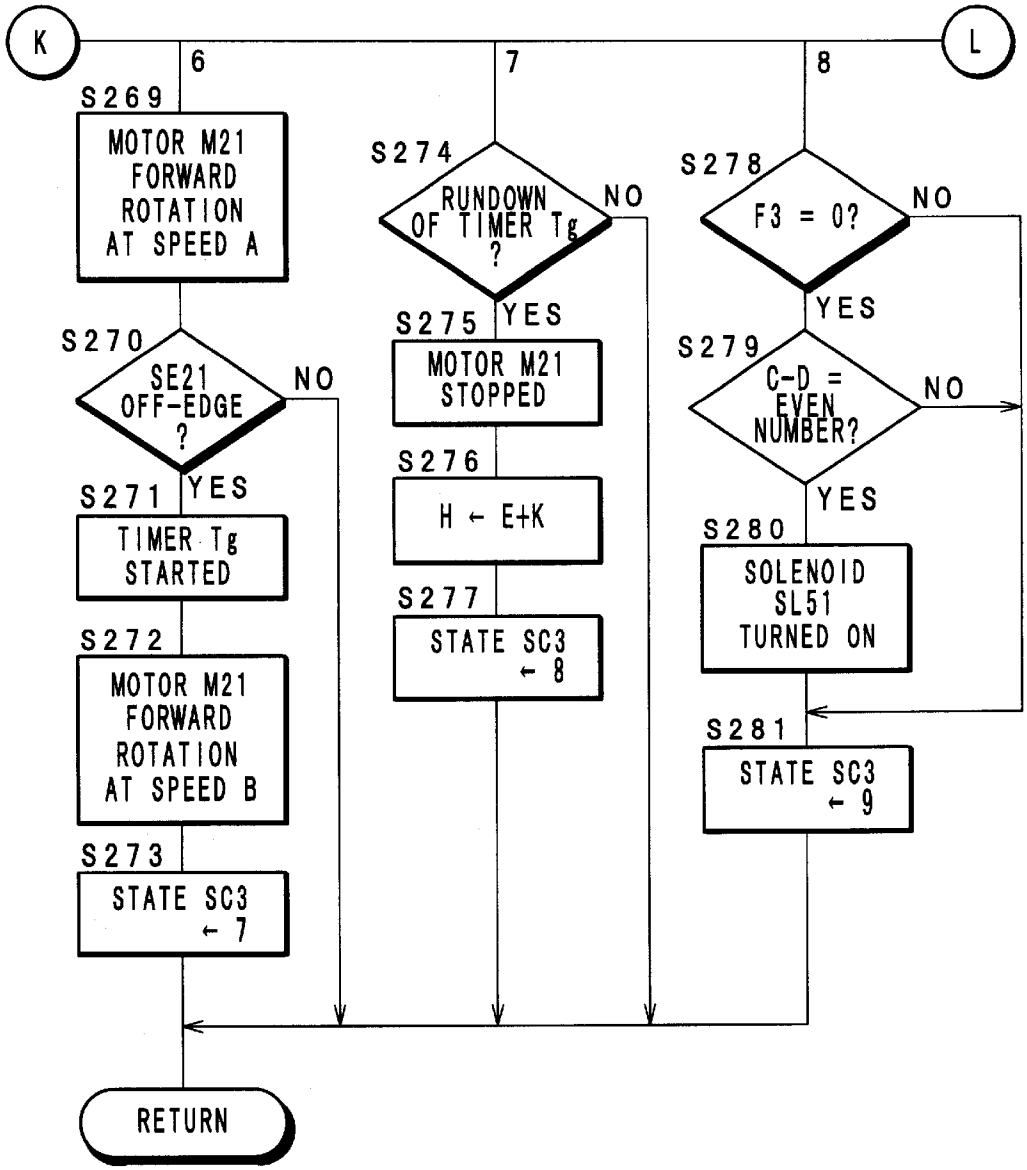

K
L
6
7
8
S269
MOTOR M21 FORWARD ROTATION AT SPEED A
S270
SE21 OFF-EDGE ?
NO
YES
S271
TIMER Tg STARTED
S272
MOTOR M21 FORWARD ROTATION AT SPEED B
S273
STATE SC3 ← 7
S274
RUNDOWN OF TIMER Tg ?
NO
YES
S275
MOTOR M21 STOPPED
S276
H ← E+K
S277
STATE SC3 ← 8
S278
F3 = 0?
NO
YES
S279
C-D = EVEN NUMBER?
NO
YES
S280
SOLENOID SL51 TURNED ON
S281
STATE SC3 ← 9
RETURN

FIG. 37e

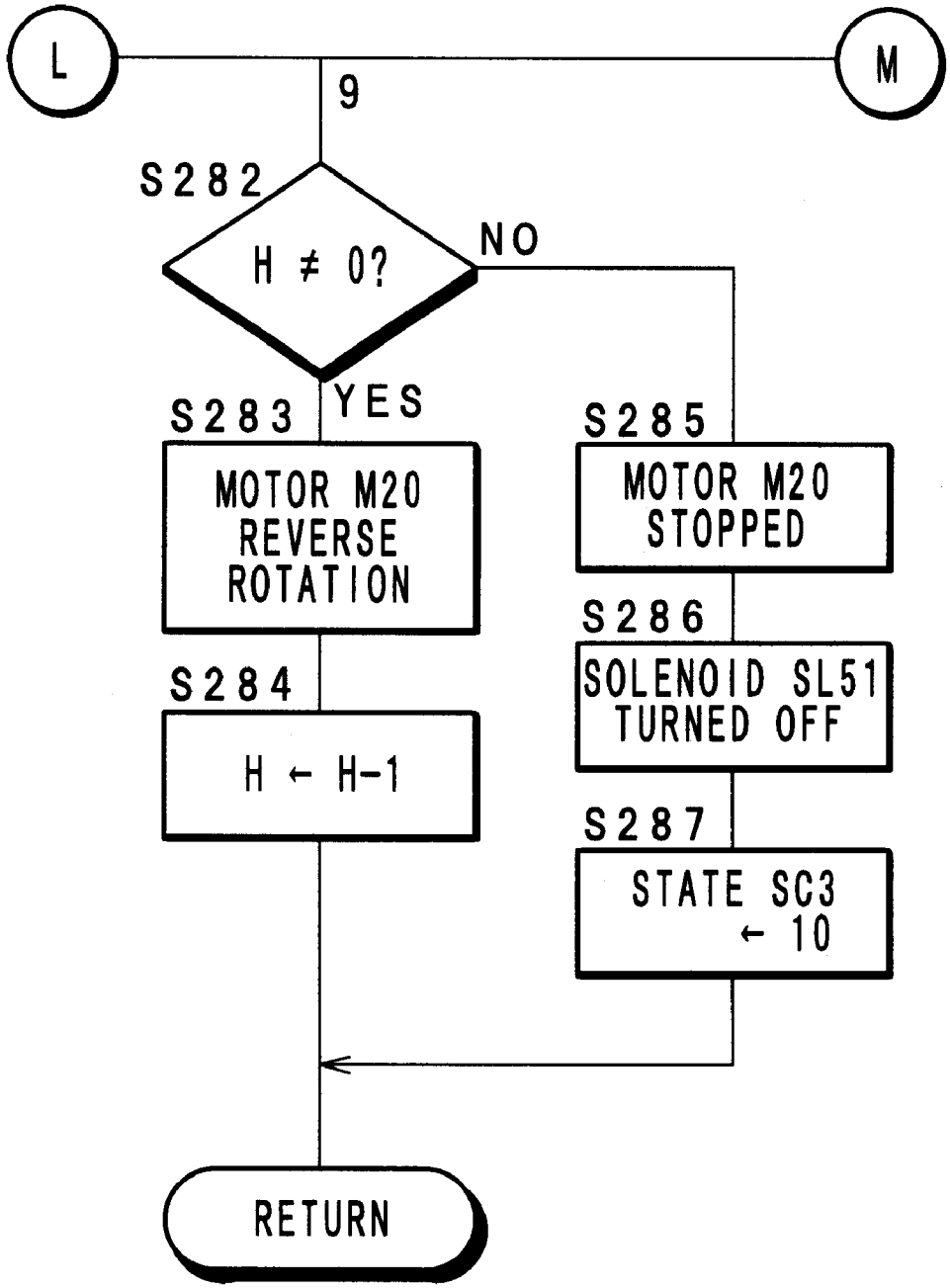

L
M
9
S282
H ≠ 0?
NO
YES
S283
MOTOR M20 REVERSE ROTATION
S284
H ← H-1
S285
MOTOR M20 STOPPED
S286
SOLENOID SL51 TURNED OFF
S287
STATE SC3 ← 10
RETURN

FIG. 37f

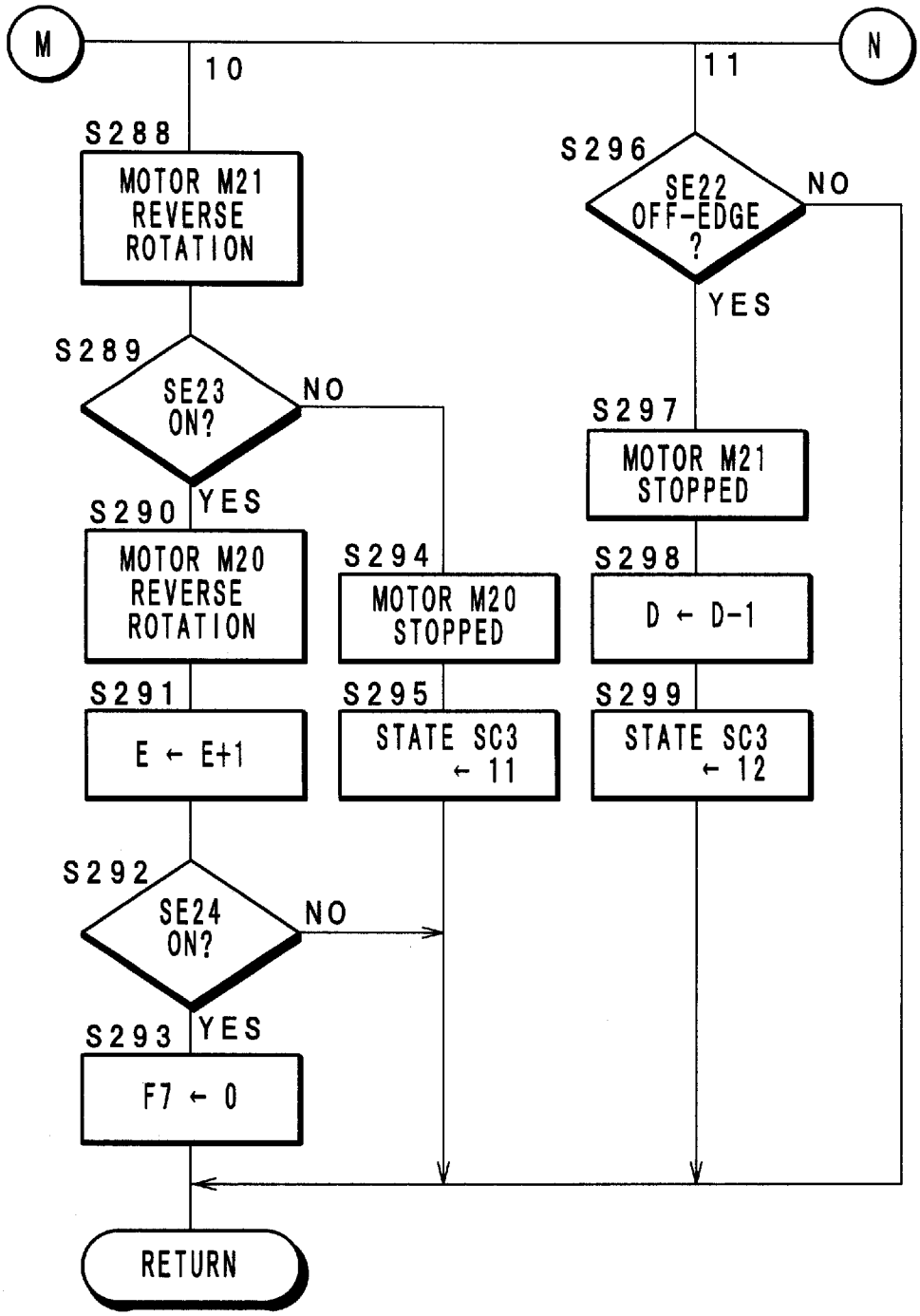

M
N
10
11
S288
MOTOR M21 REVERSE ROTATION
S289
SE23 ON?
NO
YES
S290
MOTOR M20 REVERSE ROTATION
S291
E ← E+1
S292
SE24 ON?
NO
YES
S293
F7 ← 0
RETURN
S294
MOTOR M20 STOPPED
S295
STATE SC3 ← 11
S296
SE22 OFF-EDGE ?
NO
YES
S297
MOTOR M21 STOPPED
S298
D ← D-1
S299
STATE SC3 ← 12

FIG. 37g

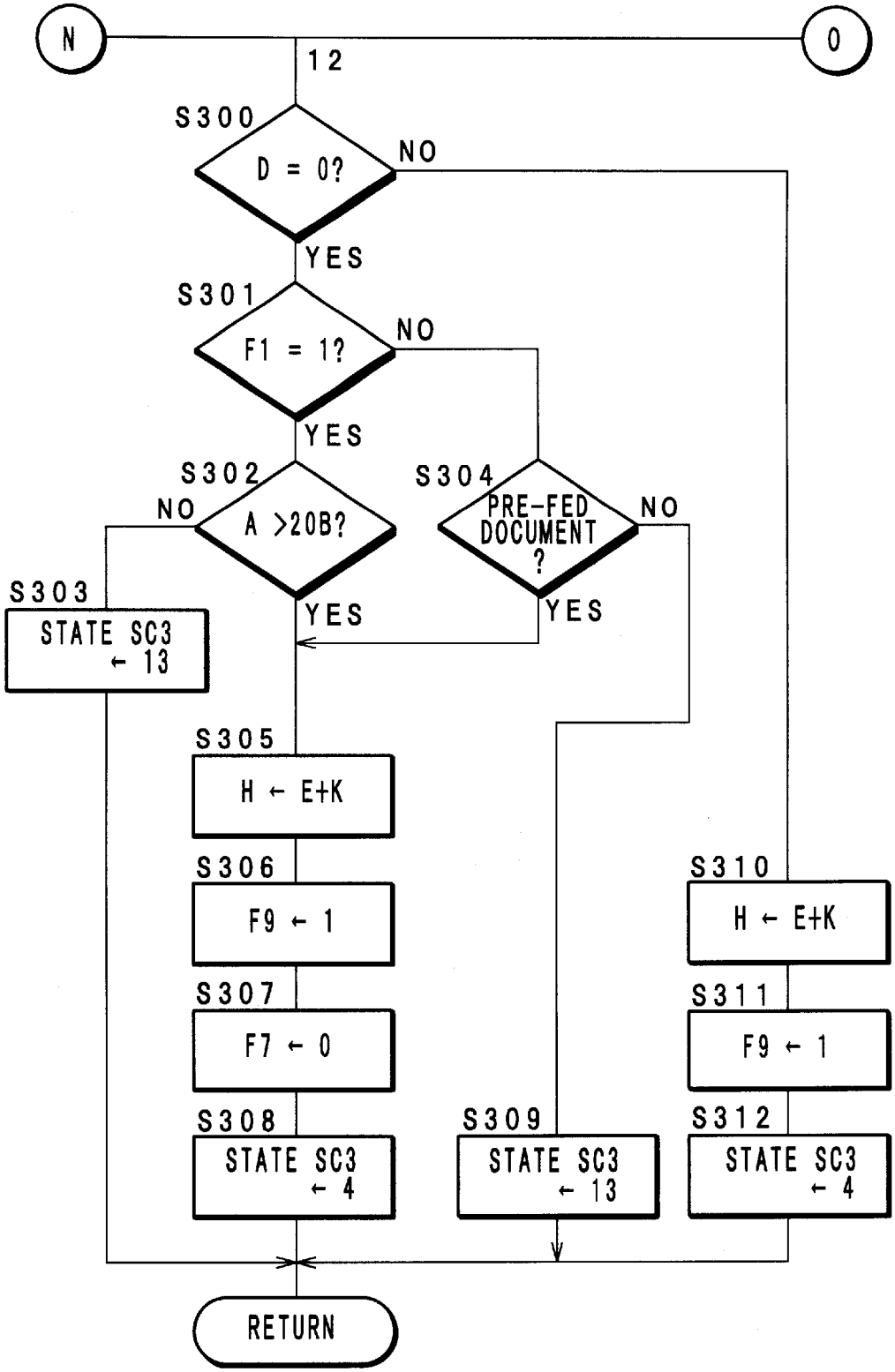

N
O
12
S300
D = 0?
NO
YES
S301
F1 = 1?
NO
YES
S302
A >20B?
NO
YES
S303
STATE SC3 ← 13
S304
PRE-FED DOCUMENT ?
NO
YES
S305
H ← E+K
S306
F9 ← 1
S307
F7 ← 0
S308
STATE SC3 ← 4
S309
STATE SC3 ← 13
S310
H ← E+K
S311
F9 ← 1
S312
STATE SC3 ← 4
RETURN

FIG. 37h

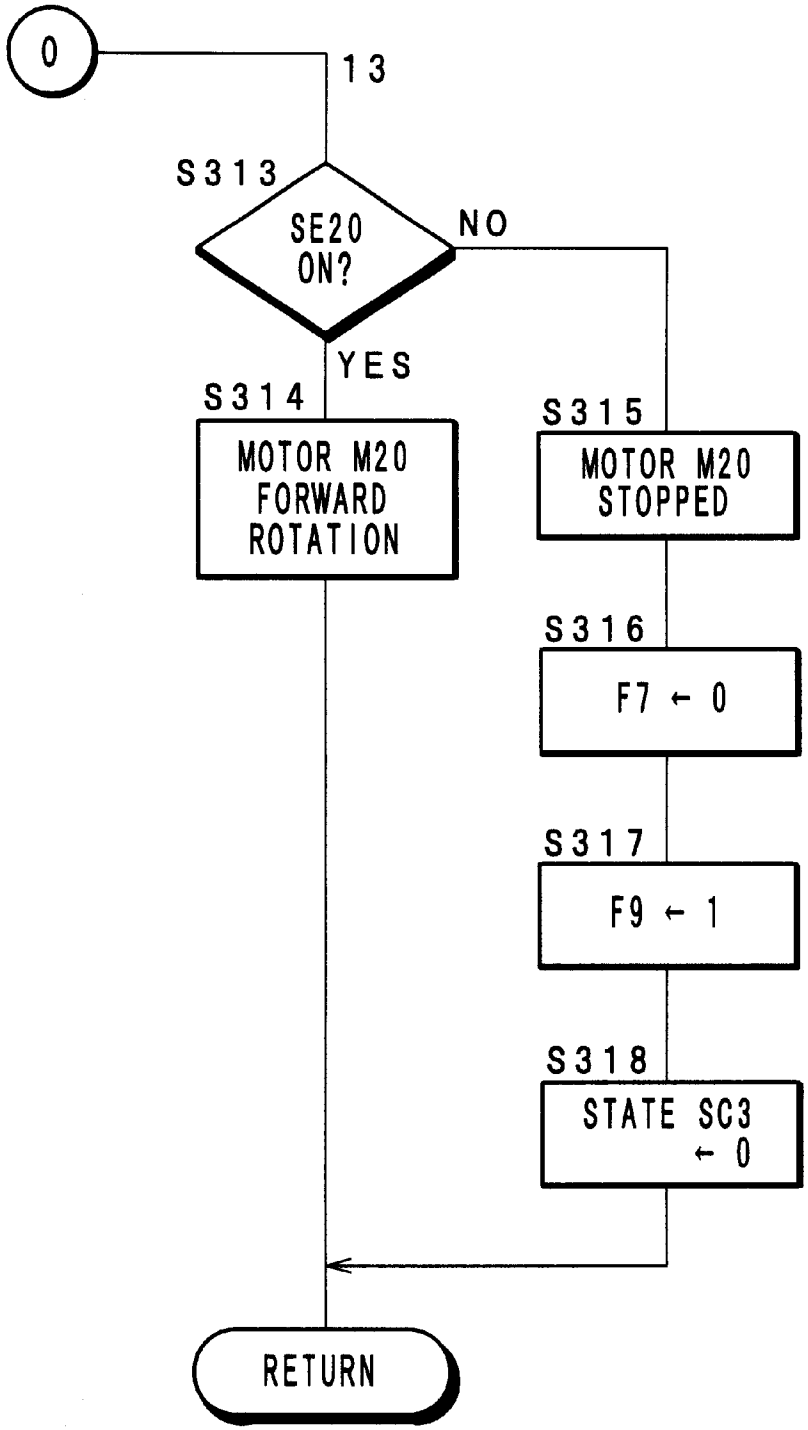
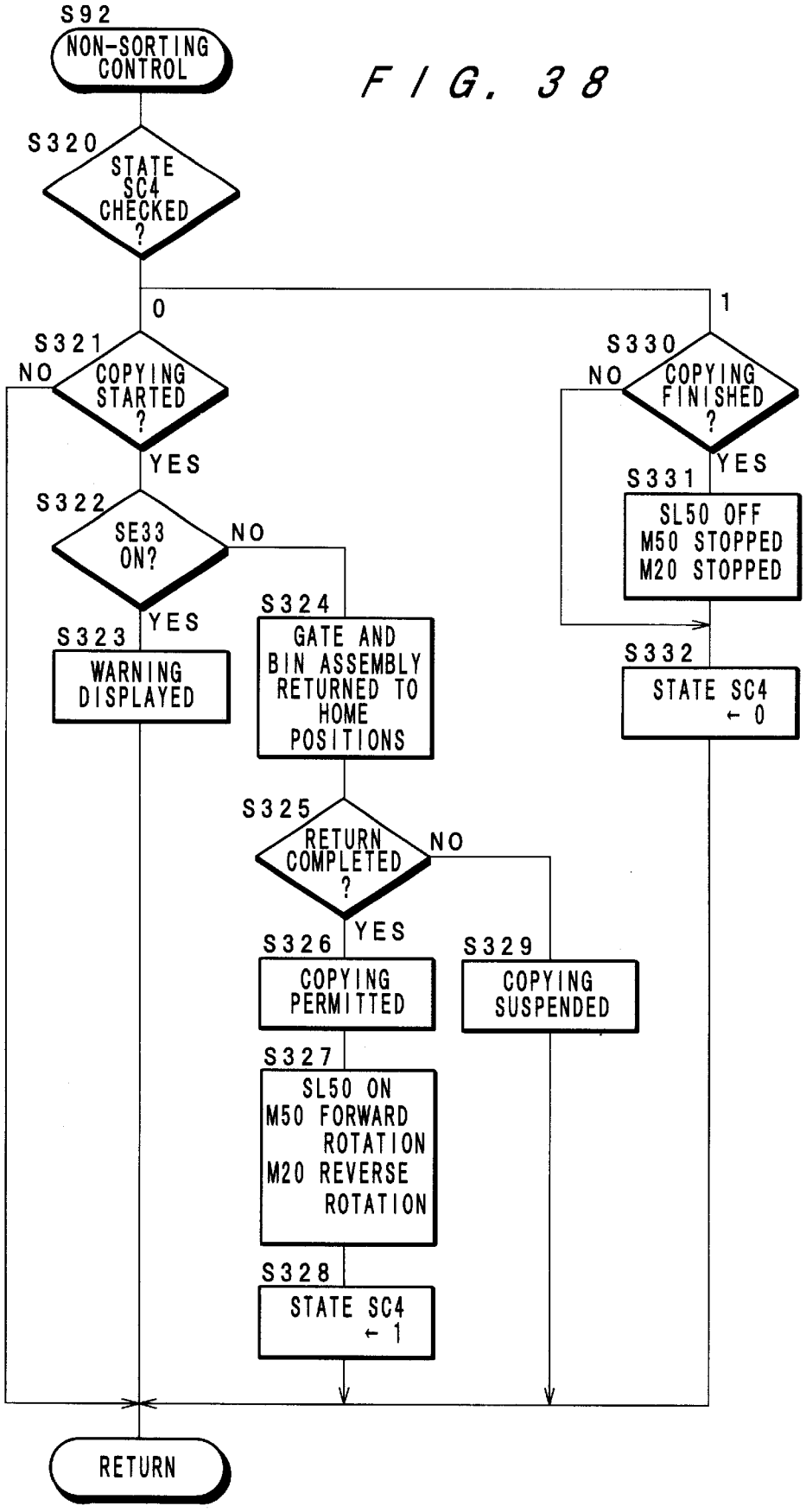

0
13
S313
SE20 ON?
NO
YES
S314
MOTOR M20 FORWARD ROTATION
S315
MOTOR M20 STOPPED
S316
F7 ← 0
S317
F9 ← 1
S318
STATE SC3 ← 0
RETURN

FIG. 38


S92
NON-SORTING CONTROL
S320
STATE SC4 CHECKED ?
0
1
S321
COPYING STARTED ?
NO
YES
S322
SE33 ON?
NO
YES
S323
WARNING DISPLAYED
S324
GATE AND BIN ASSEMBLY RETURNED TO HOME POSITIONS
S325
RETURN COMPLETED ?
NO
YES
S326
COPYING PERMITTED
S327
SL50 ON
M50 FORWARD ROTATION
M20 REVERSE ROTATION
S328
STATE SC4 ← 1
S329
COPYING SUSPENDED
S330
COPYING FINISHED ?
NO
YES
S331
SL50 OFF
M50 STOPPED
M20 STOPPED
S332
STATE SC4 ← 0
RETURN

STACK TRANSPORT FOR A SORTER WITH PRESSING DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a sheet handling apparatus, and more particularly to a sheet handling apparatus for sorting and/or stapling sheets which have obtained images in a copying machine or a printer and have been ejected therefrom.

2. Description of Related Art

Conventionally, apparatuses for handling image-formed sheets, which are called finishers, have various functions, such as a function of collating sheets (sorting), a function of grouping sheets by page so that sheets in a group will have the same page (grouping), a function of stapling sheets, a function of punching sheets, etc. Meanwhile, recently, such sheet handling apparatuses have been demanded to have a large capacity. In order to make a sheet handling apparatus have a large capacity, it is required to provide a mechanism for taking sets of sheets which have been sorted and stored in bins therefrom into a large-capacity tray set by set after stapling the sheets or without stapling the sheets.

In such a sheet handling apparatus with a large-capacity tray, when a large number of stapled sets are stacked on the tray, the stack of sheet sets is very voluminous at the stapled portion. Accordingly, the number of stapled sets which can be stacked on the tray is smaller than the number of unstapled sets which can be stacked thereon. However, this point has not been considered in designing a sheet handling apparatus, and such a conventional sheet handling apparatus is likely to have trouble in stacking stapled sets of sheets on a large-capacity tray. In such a conventional apparatus, also, because the stack of stapled sets on the tray is partly voluminous at the stapled portion, the sets stapled on the tray may become out of alignment or may bend.

There has been conventionally a type of sheet handling apparatus which has a large-capacity tray above bins. In this type, the large-capacity tray is also used as a non-sort tray which receives sheets which are not required to be distributed among the bins for sorting or grouping. The large-capacity tray also receives sets of sheets which have been distributed among the bins and transported therefrom by a vertical transporting means. When the transporting means delivers a set of sheets onto the large-capacity tray, there is a possibility that the set of sheets may push a set of sheets which have been previously delivered onto the tray. Especially when unstapled sets of sheets are being stacked on the tray, it is more likely to occur that upper sheets of a previously delivered set are punched, whereby the set will be out of alignment.

When the large-capacity tray is used as a non-sort tray, the transporting means is set on a level high above the surface of the tray so as to secure sufficient capacity of the tray for sheets. However, when sets of sheets are stacked on the tray, if the transporting means is set on this level for delivery of each set to the tray, the sets of sheets may bend.

Further, when stapled sets of sheets are stacked on the tray, the stapled portion of the stack of sets is more voluminous than the other portions, and a set currently delivered to the tray may collide with the stapled portion of the stack.

Also, there has been conventionally a type of sheet handling apparatus which has a large-capacity tray below bins. In this type, each set of sheets is dropped into the tray, and the sheets may be put out of order if the sheets are not stapled. On the other hand, in the type which has a large-capacity tray above the bins and has a mechanism for handling and lifting a set of sheets to the tray, a space for the lifting of a set of sheets is necessary, thereby increasing the size of the apparatus.

Incidentally, in order to take a set of sheets out of a bin, the present inventors have decided to adopt a method wherein the set of sheets is nipped between an upper roller and a lower roller and held up from the bin. However, an upright stopper is provided for each bin at the end portion so that sheets in each bin will be put into alignment, and each stopper has a protruding portion at the end so that sheets will not fall down from each bin even with vibration due to movement of the bin. Therefore, with a mechanism which merely nips a set of sheets between an upper roller and a lower roller and holds it up, it is likely that the set of sheets hits the edge against the stopper or is caught in the protruding portion of the stopper, thereby putting the sheets out of alignment, failing in take-out of the set of sheets and/or damaging the sheets.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an image forming apparatus which can avoid trouble in stacking stapled sets of sheets on a large-capacity tray by setting a limit to the number of stapled sets to be stacked on the tray.

Another object of the present invention is to provide a sheet handling apparatus which can prevent sets of sheets (particularly unstapled sets of sheets) stacked on a large-capacity tray from becoming out of alignment.

Another object of the present invention is to provide a sheet handling apparatus which can stack sets of sheets on a large-capacity tray smoothly.

Further, another object of the present invention is to provide a sheet handling apparatus which has a large-capacity tray above bins so as to take an unstapled set of sheets into the tray keeping the sheets in order and does not require so large a space for the transportation of a set of sheets to the large-capacity tray.

Furthermore, another object of the present invention is to provide a sheet handling apparatus which can nip a set of sheets in a bin between a pair of rollers and takes the set of sheets out of the bin without any trouble.

In order to attain the object above, an image forming apparatus according to the present invention comprises: image forming means which forms an image on a sheet; a plurality of bins among which image-formed sheets are distributed for sorting; stapling means which staples sheets stored in each of the bins; a tray on which stapled sets of sheets are stacked; conveying means which transports a set of sheets from each of the bins to the tray; recognizing means which recognizes the number of sets of sheets to be stacked on the tray; and control means which inhibits the conveying means from transporting sets of sheets when the recognized number is over a specified number.

In the image forming apparatus, the number of stapled sets of sheets which can be stacked on the tray is limited, and transportation/stacking of stapled sets of sheets onto the tray over the limit is canceled. With this control, trouble which may be caused by that the stack of stapled sets on the tray is partly voluminous at the stapled portion can be prevented.

A sheet handling apparatus according to the present invention comprises: a tray which can receive a large number of sheets thereon; a plurality of bins among which sheets are distributed for sorting; conveying means which

transports a set of sheets from each of the bins to the tray and delivers the set of sheets onto the tray; and pressing means which presses sets of sheets which have been delivered and stacked on the tray when a set of sheets is being delivered onto the tray.

In the sheet handling apparatus, when a set of sheets is delivered onto the tray by the conveying means, sets of sheets stacked on the tray are pressed by the pressing means. Thereby, it can be prevented that sets of sheets, and unstapled sets of sheets, in particular, stacked on the tray may be pushed forward by a set of sheets which is being delivered onto the tray.

In the sheet handling apparatus, further, the tray has a recess at a portion to receive a stapled portion of a set of sheets, and the pressing means has a plurality of pressing members, one of which is disposed opposite the recess. When stapled sets of sheets are stacked on the tray, the stack is partly voluminous at the stapled portion. However, with the arrangement, the stapled portion is pressed into the recess of the tray, and collision of a set of sheets currently delivered onto the tray with the stapled portion of sets of sheets stacked on the tray can be prevented.

Another sheet handling apparatus according to the present invention comprises: a plurality of bins among which sheets ejected from an image forming apparatus are distributed for sorting; a tray which is disposed above the plurality of bins; and conveying means which transports sheets ejected from the image forming apparatus one by one to the tray and transports a set of sheets from each of the bins to the tray, the conveying means being set on a first level when delivering a sheet onto the tray and set on a second level when delivering a set of sheets onto the tray.

In this sheet handling apparatus, in a non-sort mode wherein sheets are transported from the image forming apparatus directly to the tray one by one, the conveying means is set on the first level. This first level is sufficiently high above the surface of the tray so that the tray can have a sufficient capacity. On the other hand, in a stack mode wherein sets of sheets stored in the bins are transported and stacked onto the tray, the conveying means is set on the second level which is lower than the first level for delivery of each set of sheets onto the tray. In this mode, a set of sheets is dropped onto the tray from a relatively small height and thereby placed on the tray smoothly without bending. Further, by heightening the level of the conveying means for delivery of a set of sheets onto the tray as the volume of sets of sheets stacked on the tray is increasing so that a set of sheets can be dropped onto the stack of sets of sheets on the tray from a constant height at all times, a large number of sets of sheets can be stacked on the tray smoothly.

Another sheet handling apparatus according to the present invention comprises: a plurality of bins among which sheets are distributed for sorting; a tray which is provided above the bins; conveying means which transports a set of sheets from each of the bins up to the tray while holding the set of sheets at an end portion with the set of sheets hanging down from the held portion; and a guide member which guides the hanging-down portion of the set of sheets while the conveying means is transporting the set of sheets upward.

In the sheet handling apparatus, the tray is disposed above the bins, and even unstapled sets of sheets can be held and transported to the tray by the conveying means. Each set of sheets is transported upward by the conveying means while hanging down from the held portion, and during the upward movement, the hanging-down portion is guided by the guide member. Therefore, only a small space is required for the transportation. Further, if stapling means is disposed under the sheet set conveying means and the guide member, a space can be efficiently used for the transportation of a set of sheets and for the stapling means, thereby resulting in downsizing the apparatus.

Further, another sheet handling apparatus according to the present invention comprises: a plurality of bins each of which has a stopper for putting sheets in alignment in the bin; take-out means which takes a set of sheets out of each of the bins keeping the sheets in alignment; and put-away means which, when the take-out means takes a set of sheets out of a bin, puts the set of sheets away from the stopper.

In the sheet handling apparatus, a set of sheets in a bin is put away from the stopper by the put-away means immediately before being taken out of the bin by the take-out means. Therefore, there is no possibility that a set of sheets may hit the edge against the stopper while being taken out of the bin. Also, even if the stopper has a protruding portion. With this arrangement, consequently, a set of sheets can be taken out of a bin by the take-out means without putting the sheets out of alignment, damaging the sheets or any other trouble.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will be apparent from the following description with reference to the accompanying drawings, in which:

FIG. **1** is a front view of a copying machine and a staple-sorter which is an embodiment of the present invention;

FIG. **2** is an elevational view of the staple-sorter showing the general structure thereof;

FIG. **3** is a front view of a second conveyer section and a take-out unit in the staple-sorter, showing a time of delivering a sheet into a bin;

FIG. **4** is a front view of the second conveyer section and the take-out unit, showing a time of taking a set of sheets out of a bin;

FIG. **5** is a schematic view of a driving system of the take-out unit;

FIG. **6** is a sectional view of the driving system;

FIG. **7** is a front view of the driving system, showing a time of delivering a sheet into a bin;

FIG. **8** is a front view of the driving system, showing a time of taking a set of sheets out of a bin;

FIGS. **9***a* and **9***b* are illustrations which show a set of sheets being taken out of a bin;

FIG. **10** is an illustration which shows a set of sheets being taken out of a bin;

FIG. **11** is an elevational view of the upper portion of the staple-sorter, showing a home position of a sheet set conveyer gate;

FIG. **12** is an elevational view of the upper portion of the staple-sorter, showing a second position of the sheet set conveyer gate;

FIGS. **13***a* through **13***f* are illustrations which show the operation of the staple-sorter for stapling/take-out/stacking of a set of sheets;

FIG. **14** is a side view of gate rollers;

FIG. **15** is an illustration which shows operation of the gate rollers;

FIG. **16** is a side view of guide plates attached to the gate rollers;

FIG. **17** is an illustration which shows a sheet being transported by the gate rollers;

FIG. **18** is an illustration which shows a set of sheets being transported by the gate rollers;

FIG. **19** is an elevational view of a gate roller shifting mechanism;

FIG. **20** is an illustration which shows sets of sheets stacked on a non-sort tray;

FIG. **21** is an illustration which shows sets of sheets stacked on the non-sort tray;

FIG. **22** is a sectional view of a structure for arranging of sheet pressing sticks;

FIGS. **23***a*, **23***b* and **23***c* are illustrations which show operation of the sheet pressing sticks;

FIG. **24** is a plan view of an operation panel of the copying machine;

FIG. **25** is a plan view of a screen displayed on a touch panel of the operation panel;

FIG. **26** is a plan view of another screen displayed on the touch panel;

FIG. **27** is a block diagram which shows the control circuit of the copying machine and the staple-sorter;

FIG. **28** is a flowchart which shows the main routine of a CPU of the control circuit;

FIG. **29** is a flowchart which shows a subroutine for initial gate operation;

FIG. **30** is a flowchart which shows a subroutine for an input process;

FIG. **31** is a flowchart which shows a subroutine for a mode switch process;

FIGS. **32***a* and **32***b* are flowcharts which show a subroutine for a mode input process;

FIG. **33** is a flowchart which shows a subroutine for an excess stack process;

FIG. **34** is a flowchart which shows a subroutine for a finish process;

FIGS. **35***a* through **35***g* are flowcharts which show a subroutine for control of the bins;

FIGS. **36***a* and **36***b* are flowcharts which show a subroutine or control of the take-out unit;

FIGS. **37***a* through **37***h* are flowcharts which show a ubroutine for control of the sheet set conveyer gate; and

FIG. **38** is a flowchart which shows a subroutine for control or non-sorting.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

An embodiment of the present invention is described with reference to the accompanying drawings. In the embodiment below, the present invention is applied to a staple-sorter which is connected to an electrophotographic copying machine.

In FIG. **1**, the reference numerals **1** and **10** denote an electrophotographic copying machine and a staple-sorter, respectively. The copying machine **1** forms an image on a sheet by a conventional electrophotographic method and has a circulating type automatic document feeder **5** on its top. The automatic document feeder **5** feeds a stack of documents out of a tray one by one onto a platen glass. Then, each document on the platen glass is ejected therefrom and returned onto the tray after being exposed a number of times equal to the number of copies to be made (registered number) specified by the operator. After one circulation, if necessary, the documents are further fed for the second and the third circulation. The automatic document feeder **5** has a function of counting the number of fed documents.

FIG. **2** shows the staple-sorter **10**. The staple-sorter **10** generally comprises a large-capacity non-sort tray **20**, a bin assembly **30** with a stack of twenty bins **31** (**31**$_1$ through **31**$_{20}$), a take-out unit **40** which takes a set of sheets out of each bin **31**, a staple unit **70**, a sheet conveyer section **80** and a sheet set conveyer gate **100**.

This staple-sorter **10** is capable of handling sheets which have obtained images in the copying machine **1** and have been ejected therefrom in the following modes: a non-sort mode of stacking sheets on the non-sort tray **20** without sorting; a sort mode of distributing sheets among the bins **31** to store each collated set of sheets in each bin **31**, a sort/staple mode of stapling each collated set of sheets, a sort/staple/stack mode of taking the collated and stapled sets of sheets out of the respective bins **31** and transporting/stacking the sets of sheets onto the non-sort tray **20**; a sort/stack mode of taking the collated sets of sheets out of the respective bins **31** without stapling the sheets, and transporting/stacking the sets of sheets onto the non-sort tray **20**; a group mode of distributing sheets among the bins **31** to store sheets with the same page in a bin; a group/staple mode of stapling each set of sheets having the same page; a group/staple/stack mode of taking the stapled sets of sheets, the sheets in each set having the same page, out of the respective bins **31** and transporting/stacking the sets of sheets onto the non-sort tray **20**; and a group/stack mode of taking the sets of sheets, the sheets in each set having the same page, out of the respective bins **31** without stapling the sheets, and transporting/stacking the sets of sheets onto the non-sort tray **20**.

Next, the internal structure of the staple-sorter **10** is described.

The sheet conveyer section **80** comprises a pair of receiving rollers **81** for receiving a sheet ejected from the copying machine **1**, a diverter **82** for switching the direction in which the sheet is to be conveyed, a first conveyer section **83** which extends substantially vertically, a second conveyer section **90** which extends substantially horizontally from the first conveyer section **83** toward the bin assembly **30**. The diverter **82** is so mounted as to pivot on a pin **82***a* with turning-on and turning-off of a solenoid SL**50**. The diverter **82** is in a position shown by the solid line in FIG. **2** while the solenoid SL **50** is off. In this state, a sheet received by the receiving rollers **81** is guided by a curved surface on the right side of the diverter **82** into the first conveyer section **83**. When the solenoid SL **50** is turned on, the diverter **82** pivots clockwise slightly. In this state, a sheet received by the receiving rollers **81** is guided by the upper surface of the diverter **82** and a guide plate **79** and is transported to the non-sort tray **20** through the sheet set conveyer gate **100** as described below.

The first conveyer section **83** comprises guide plates **84**, **85**, **86** and **87**, and pairs of transport rollers **88** and **89**. A punch unit **75** for punching a sheet at its leading portion or trailing portion is provided in the middle of the first conveyer section **83**. The detailed description of the punch unit **75** is omitted.

The second conveyer section **90** comprises a pair of transport rollers **91** and **92** and guide plates **93** and **94**. The guide plate **94** is fitted to a side wall **93***a* of the guide plate **93** (see FIGS. **3** and **4**), and the transport roller **91** is fitted to an end of the guide plate **94**. The second conveyer section **90** is capable of pivoting approximately 90 degrees in the direction of arrow "a" on a shaft **95**. The other transport roller **92** is fitted to a frame **96** via a shaft **97**. In the sort mode and in the group mode, the second conveyer section **90**

is set in a position shown by the solid line in FIGS. **2** and **3** so as to convey sheets sent from the first conveyer section **83** to the bins **31** with the transport rollers **91** and **92**. At a time of taking sets of sheets out of the bins **31**, which will be described later, the second conveyer section **90** pivots approximately 90 degrees in the direction of arrow "a" and comes to an upright position to retreat from the sheet conveying position.

The second conveyer section **90** is also provided with a sensor **21** for detecting a sheet being delivered into each bin **31** and a set of sheets being taken out of the bin **31**. The pairs of rollers **81**, **88**, **89**, **91** and **92**, and take-out rollers **42** and **45**, which will be described later, are driven to rotate by a motor M**50** via a transmission system (not shown).

The bin assembly **30** comprises a stack of twenty bins **31**, through $\mathbf{31}_{20}$, and the bins **31** are disposed at uniform intervals with an inclination. A pin **32** provided at the lower end of each bin **31** is in engagement with a spiral groove formed on the circumference of a vertical drive shaft (not shown). The drive shaft is rotated in forward/reverse directions by a motor M**60**, and one revolution of the drive shaft elevates or lowers the bins **31** by one pitch. When the bin assembly **30** is in its lowest position (home position) shown by the solid line in FIG. **2**, the first bin $\mathbf{31}_1$ faces the transport rollers **91** and **92**. The level where a bin **31** faces the transport rollers **91** and **92** is hereinafter referred to as level X_2. With one reverse revolution of the drive shaft, the first bin $\mathbf{31}_1$ is lowered from the level X_2 to a level X_1 where the bin $\mathbf{31}_1$ faces the staple unit **70**. On this level X_1, sheets in the first bin $\mathbf{31}_1$ are stapled. Then, with one forward revolution of the drive shaft, the first bin $\mathbf{31}_1$ is lifted to the level X_2, where the stapled set of sheets is taken out of the bin $\mathbf{31}_1$. Simultaneously, the lower bins $\mathbf{31}_2$ through $\mathbf{31}_{20}$ are lifted by one pitch, and the second bin $\mathbf{31}_2$ is set on the level X_1. When a bin **31** is set on the level X_1 or the level X_2, the bin is put at a larger interval from the next bin than the intervals among the other bins. This change in the intervals among the bins **31** can be realized by providing a change in the pitch of the spiral groove formed on the circumference of the drive shaft.

In this embodiment, both delivery of a sheet into a bin **31** and take-out of a set of sheets from a bin **31** are carried out on the level X_2, which contributes to simplification of the sorter section.

The bin assembly **30** has a sensor which detects that the bin assembly **30** is in the home position and a sensor which detects that the bins **31** have been lifted by one pitch with one revolution of the drive shaft, although they are not shown in the drawings. Also, a transmission sensor SE**34** is provided to detect the presence or absence of sheets in each bin **31**. Further, a sensor SE**35** is provided to detect the presence or absence of sheets in a bin **31** set on the level X_2. If the sensor SE**35** does not detect any sheets in a bin **31** on the level X_2 (for example, in a case that the operator has taken sheets out of the bin **31**), the take-out process from the bin **31** and the transport/stack process onto the non-sort tray **20** are cancelled, and immediately, the operation proceeds to a take-out process from the next bin **31**.

Now, the staple unit **70** is described. The staple unit **70**, which is a conventional electrical one, comprises a head **71** where a cartridge containing staples can be attached and detached and an anvil **72** which receives and bends a staple struck out from the head **71**. The staple unit **70** moves toward a bin **31** set on the level X_1 and staples sheets in the bin **31** at one point on a corner or at two points in the center (see FIG. **13***b*). The staple unit **70** is initially in its home position at the front side of the staple-sorter **10** and is movable toward the rear side. The staple unit **70** moves toward the bin **31** (toward the rear side) and stops at a specified position to staple the sheets in the bin **31**, and then, the staple unit **70** returns to the home position. Each bin **31** has cutouts on its bottom at staple positions, so that the end of the staple unit **70** can enter each bin **31**.

Next, the take-out unit **40** is described.

The take-out unit **40** is to grab a set of sheets in a bin **31** set on the level X_2 and take the set of sheets out of the bin **31**. As shown in FIGS. **3** and **4**, the take-out unit **40** has a push-away lever **41** which pushes sheets stored in a bin **31** away from a stopper **34** of the bin **31**, a lower roller **43** which holds up the sheets and an upper roller **42** which provides pressure to the sheets from the above. The upper roller **42** is fitted to an upper arm **45** which is pivoted on the shaft **95**, and the lower roller **43** is fitted to a lower arm **46** which is pivoted on the shaft **47**.

The take-out unit **40** and the second conveyer section **90**, as shown in FIG. **5**, are moved by a reversible motor M**70** via a first driving system **50**A and a second driving system **50**B respectively. The first driving system **50**A moves the second conveyer section **90** and the upper arm **45**, and the second driving system **50**B moves the lower arm **46**. Each of the driving systems **50**A and **50**B has a one-way mechanism (not shown), so that forward rotation and reverse rotation of the motor M**70** actuate the first driving system **50**A and the second driving system **50**B respectively.

More specifically, as FIGS. **6**, **7** and **8** show, a belt **49** is stretched among an output pulley **48** of the motor M**70** and one-way pulleys **51***a* and **51***b*. In the first driving system **50**A, a worm gear **53***a*, which is fixed to a shaft **52***a* of the one-way pulley **51***a*, is in engagement with a worm wheel **54***a*. In the second driving system **50**B, a worm gear **53***b*, which is fixed to a shaft **52***b* of the one-way pulley **51***b*, is in engagement with a worm wheel **54***b*.

Further, the first driving system **50**A has levers **56** and **57** which are connected to each other by a boss **56***a*. The lever **56** is capable of pivoting on a shaft **58**, and a pin **55***a* standing on the worm wheel **54***a* is in engagement with a groove **56***b* formed on the lever **56**. The end of the other lever **57** is connected to a side wall **93***a* of the guide plate **93** via a pin **59**. With forward rotation (in the direction of arrow "a") of the motor M**70**, the worm wheel **54***a* rotates in the direction of arrow "a" in FIG. **7**, and the lever **56** pivots on the shaft **58** in the direction of arrow "a". Accordingly, the lever **57** and the second conveyer section **90** (the guide plates **93** and **94**) pivot on the shaft **95** in the direction of arrow "a" (see FIG. **8**). Simultaneously, the upper arm **45** pivots on the shaft **95** in the direction of arrow "a", and the upper roller **45** comes down onto a set of sheets S in a bin **31** set on the level X_2.

The second driving system **50**B has a sector gear **60** which is capable of pivoting on a shaft **61**. The sector gear **60** is in engagement with a gear **62**, and the gear **62** is fitted to the lower arm **46** via a shaft **47**. A pin **55***b* standing on the worm wheel **54***b* is in engagement with a groove **60***a* formed on the sector gear **60**. With reverse rotation (in the direction of arrow "b") of the motor M**70**, the worm wheel **54***b* rotates in the direction of arrow "b", and the sector gear **60** pivots on the shaft **61** in the direction of arrow "b". Accordingly, the gear **62** rotates in the direction of arrow "c".

Simultaneously, the lower arm **46** pivots on the shaft **47** in the direction of arrow "c" (see FIG. **3**), and the lower roller **43** comes to the set of sheets S in the bin **31** set on the level X_2 and holds up the set of sheets S.

With further forward or reverse rotation of the motor M70, the worm wheel 54*a* or 54*b* further rotates in the direction of arrow "a" or in the direction of arrow "b", and thus, the second conveyer section 90 and the upper roller 42, or the lower roller 43 return(s) from the position for take-out of sets of sheets from the bins 31 shown in FIG. 4 to the position for delivery of sheets into the bins 31 shown in FIG. 3.

As FIG. 3 shows, the guide plates 93 and 94 and the frame 96 of the second conveyer section 90 form a sheet transport path at a time of sheet delivery to the bins 31 in the sort mode and the group mode. The frame 96 is connected to a lever 64 via a pin 63, and the lever 64 is connected to a guide plate 66 via a pin 65. Further, the guide plate 66 is connected to the pin 59. Accordingly, when the second conveyer section 90 comes upright at a time of sheet set take-out from the bins 31, as shown in FIG. 4, a protruding portion 93*b* of the guide plate 93, the frame 96 and the guide plate 66 form a sheet transport path. At this time, the transport roller 91 comes upward to retreat from the sheet transport path.

As shown in FIG. 3, a sensor SE53 detects that the second conveyer section 90 is set in the position for sheet delivery to the bins 31, and a sensor SE54 detects that the second conveyer section 90 comes upright to the position for sheet set take-out from the bins 31. Also, a sensor SE55 detects that the lower arm 46 is in the retreating position, and a sensor SE56 detects that the lower arm 46 comes to the position to hold up a set of sheets.

Each of the bins 31 is provided with a stopper 34 at the lower end, and each stopper 34 has a protrusion 34*a* for preventing sheets from falling down from the bin 31 due to vibration caused by the upward/downward movement of the bins 31 (see FIGS. 2 and 3). Therefore, when the lower roller 43 holds up a set of sheets from a bin 31 for take-out of the set of sheets, it is necessary to prevent the edge of the set of sheets from scraping against the stopper 34 and from being caught in the protrusion 34*a*. For this purpose, the push-away lever 41 pushes the set of sheets slightly away from the stopper 34. This push-away lever 41 is capable of pivoting on the shaft 97 of the transport roller 92. The lever 41 hangs down by its own weight and leans on the lower arm 46. With rotation of the lower arm 46 in the direction of arrow "c" for sheet set take-out, a cam surface 46*a* formed on the lower arm 46 pushes the lever 41. Thereby, the lever 41 pivots on the shaft 97 in the direction of arrow "e" and pushes the set of sheets on the bin 31 away from the stopper 34. Each of the bins 31 has cutouts on the bottom so that the push-away lever 41, the lower roller 42 and the lower arm 46 can enter the bins 31 through the cutouts.

While the second conveyer section 90 is in the position for sheet delivery to the bins 31, the upper arm 45 holding the upper roller 42 is upright supported by a protruding portion 93*b* of the guide plate 93. When the second conveyer section 90 pivots in the direction of arrow "a" to move to the position for sheet set take-out from the bins 31, the protruding portion 93*b* releases the upper arm 45, and the upper arm 45 pivots on the shaft 95 in the direction arrow "a" to a position shown by the two-dot chain line in FIGS. 3 and 5 by its own weight. When the lower roller 43 holds up the set of sheets S from the bin 31, the upper roller 42 comes into contact with the set of sheets S from the above, and thus, the set of sheets S is nipped between the rollers 42 and 43. Then, with rotation of the rollers 42 and 43, the set of sheets S is taken out of the bin 31 in the direction of arrow "d" in FIG. 4. Thereafter, the set of sheets S is received by rollers 102 and 103 of the sheet set conveyer gate 100 which has been lowered to a take-out position.

During the transportation of the set of sheets S from the take-out rollers 42 and 43 to the gate rollers 102 and 103, if the sheets S are not stapled, the sheets S may become out of alignment when the rotation of the take-out rollers 42 and 43 is started or when the sheets S come between the gate rollers 102 and 103. More specifically, in the state that the set of sheets S is nipped between the rollers 42 and 43 as shown in FIG. 9*a*, when a driving force is applied to the lower roller 43, all the sheets S cannot follow the acceleration of the transporting speed applied from the lower roller 43, and the lower sheets are fed ahead from the upper sheets as shown in FIG. 9*b*. Also, when the leading edge of the set of sheets S comes between the gate rollers 102 and 103, the sheets near the nip portion are fed ahead.

In order to avoid the trouble, at least the following measures must be taken: (1) setting the transporting speed (circumferential speed) of the gate rollers 102 and 103 higher than that of the take-out rollers 42 and 43; (2) using a material with a low coefficient of friction for the take-out rollers 42 and 43; and (3) setting the nipping force of the take-out rollers 42 and 43 larger than that of the gate rollers 102 and 103.

Specifically, the take-out rollers 42 and 43 are made of silicone rubber (its coefficient of friction is 0.3), and the gate rollers 102 and 103 are made of EPDM (ethylene-propylene-diene-methylene rubber) (its coefficient of friction is 1.1). The take-out rollers 42 and 43 have a nipping force of approximately 350 gf, and the gate rollers 102 and 103 have a nipping force of approximately 100 gf. The transporting speed of the take-out rollers 42 and 43 is approximately 350 mm/sec, and that of the gate rollers 102 and 103 is approximately 450 mm/sec. These values are only examples.

Next, the sheet set conveyer gate 100 is described.

The sheet set conveyer gate 100, as shown in FIGS. 2 and 11, has a pair of gate rollers 102 and 103 and guide plates 104 and 105 in a box 101. The rollers 102 and 103 are driven to rotate forward and in reverse by a motor M21. The sheet set conveyer gate 100 is movable up and down along a guide member (not shown), and the driving source of this vertical movement is a motor M20. The sheet set conveyer gate 100 is initially in a home position shown by the solid line in FIG. 2, and in this home position, the gate 100 transports sheets which have been sent from the receiving rollers 81 and guided by the upper surface of the diverter 82 to the left in FIG. 2 and conveys the sheets onto the non-sort tray 20 with rotation of the rollers 102 and 103.

Also, the sheet set conveyer gate 100 moves down to a take-out position around the level X_2 to receive a stapled or unstapled set of sheets from a bin 31 set on the level X_2 (see FIG. 13*a*). In the take-out position, the gate 100 nips the set of sheets S which has been taken out of the bin 31 by the take-out rollers 42 and 43 with the rollers 102 and 103 (see FIG. 13*b*) and takes the set S inside with forward rotation of the rollers 102 and 103 (see FIG. 13*c*). When the set of sheets S are taken in the gate 100 completely, the forward rotation of the rollers 102 and 103 is stopped, and the gate 100 moves upward (see FIG. 13*d*). The gate 100 comes up to a specified level (delivering position), the rollers 102 and 103 are rotated in reverse to discharge the set of sheets S onto the non-sort tray 20 (FIG. 13*e*). Then, the gate 100 moves down to the take-out position again (see FIG. 13*f*) to repeat this transport/stack process.

As FIG. 13*d* shows, while the set of sheets S is transported upward nipped between the rollers 102 and 103, the set of sheets S hangs down, and the hanging-down portion of the set S is guided by the guide plate 86. With this arrangement,

only a small space is necessary for the upward transportation of the set of sheets S, which is an efficient usage of the internal space of the sorter **10**. Further, by locating the staple unit **70** under the gate **100** and the guide plate **86**, the space for the upward transportation of a set of sheets and the space for the staple unit **70** can be saved.

In this embodiment, a set of sheets stored in a bin **31** is stapled at the trailing portion with respect to the direction of sheet delivery to the bin **31**, and the stapled set of sheets is lifted by the gate **100** with the leading portion with respect to the direction of sheet delivery to the bin **31** nipped between the rollers **102** and **103**. Then, when the stapled set of sheets is delivered to the non-sort tray **20**, the leading portion with respect to the direction of sheet delivery to the bin **31** (unstapled portion) first enters the non-sort tray **20**. Accordingly, stapled sets of sheets are stored in the non-sort tray **20** with the stapled portions at the lower portion of the tray **20**. Therefore, there is no possibility that the leading edge of a stapled set of sheets which is being delivered to the non-sort tray may be caught by the stapled portion of the previously delivered set, and thus, stacking of stapled sets of sheets on the non-sort tray can be carried out smoothly.

The sheet set conveyer gate **100** functions as a path of a sheet to the non-sort tray **20** and also as a path of a set of sheets to the tray **20**. Therefore, the guide plates **104** and **105** are disposed at an interval which is sufficient to allow a set of sheets to pass through. The movable guide plate **79** of the first conveyer section **83** is pushed up by a set of sheets S which has been lifted by the gate **100**, and the guide plate **79** pivots upward on the shaft **78**.

As FIG. **14** shows, a driving force is transmitted from a gear **124** to the gate roller **102** via gears **125** and **126** and to the gate roller **103** via a gear **127**. A link **128** which holds the roller **102** and a link **129** which holds the roller **103** are connected via a shaft **121** which supports the gear **124**. Therefore, when the rollers **102** and **103** nip a set of sheets, the links **128** and **129** pivot on the shaft **121**, so that the rollers **102** and **103** separate from each other at a distance in accordance with the thickness of the set of sheets. When the set of sheets S hangs down in the right of the rollers **102** and **103** as shown in FIG. **15**, the transmission of the driving force to the rollers **102** and **103** is stopped. (This is the time to start the upward transportation of the set of sheets S from the take-out position to the non-sort tray **20**.) In this state, because of the weight of the set of sheets S, the rollers **102** and **103** are provided with forces to rotate in the directions of arrow "g" and arrow "g" respectively. At this time, the links **128** and **129** are provided with forces to pivot on the shaft **121** downward and upward respectively, and with these forces, the rollers **102** and **103** can nip the set of sheets S more strongly. Thereby, a slip of the set of sheets S while being transported upward can be prevented, and especially if the set of sheets S is not stapled, it is efficiently prevented that the sheets S may become out of alignment or slip down from the rollers **102** and **103**.

The rollers **102** and **103** are capable of separating from each other and coming closer to each other as described above. Further, as FIG. **16** shows, a guide plate **111** extends between wheels of the upper roller **102**, and a guide plate **115** is provided between wheels of the lower roller **103**. The guide plate **111** is capable of pivoting on a shaft **112** and is pulled in the counterclockwise direction in FIG. **16** by a coil spring **113** and regulated to stop at the position shown by the solid line in FIG. **16**. The guide plate **111**, in the non-sort mode, guides a sheet which is traveling in the direction of arrow "f" to the nip portion between the rollers **102** and **103** with its lower surface **111***a*. On the other hand, at a time of sheet set take-out, the guide plate **111**, together with the upper roller **42**, is pushed up by a set of sheets which is coming between the rollers **102** and **103** in the direction of arrow "d". At this time, first, the wheels of the upper roller **42** are pushed up by the set of sheets, and the shaft **122** pushes up the guide plate **111** against the force of the coil spring **113**. In this way, the plate **111** retreats upward from the set of sheets, and although the guide plate **111** has a function of guiding the set of sheets, it does not offer resistance to the set of sheets.

The other guide plate **115** is capable of pivoting on a shaft **116** and is pulled in the counterclockwise direction by a coil spring **117** and regulated to stop at the position shown in FIG. **16**. As FIG. **17** shows, in the non-sort mode, the guide plate **115** offers resistance with a strength corresponding to the force of the spring **117** to a sheet s, so that the sheet s is delivered onto the non-sort tray **20** while being stretched. On the other hand, at a time of sheet set take-out, because the force of the coil spring **117** is smaller than the weight of a set of sheets, as FIG. **18** shows, when a set of sheets S comes between the rollers **102** and **103**, the guide plate **115** pivots downward on the shaft **116**. The force of the coil spring **117** is sufficiently large so that the guide plate **115** will not be pushed down by a sheet in the non-sort mode even if the sheet is unordinary paper such as thick paper, OHP paper or the like.

Further, when unstapled sets of sheets are transported to and stacked on the non-sort tray **20** by use of the sheet set conveyer gate **100**, the sets of sheets S_1, S_2, S_3 . . . are placed on the tray **20** so as to shift alternately from one another in a direction perpendicular to the direction in which the gate **100** delivers a set of sheets to the tray **20**. This shift is realized by shifting the gate rollers **102** and **103** by a distance W (see FIG. **20**) while the gate **100** is transporting a set of sheets in an even number in the order from the take-out position up to the delivering position nipping the set of sheets between the rollers **102** and **103**.

For the shift, as shown in FIG. **19**, a fixed frame **130** and a movable frame **133** which supports the rollers **102** and **103** are provided in the gate **100**. The fixed frame **130** is fixed inside the box **101**. The movable frame **133** has side walls **133***a* and **133***b* which are connected to each other by a connecting board **133***c*, and the roller shafts **122** and **123** are supported by the side walls **133***a* and **133***b*. The side walls **133***a* and **133***b* of the movable frame **133** are capable of sliding along a guide shaft **131** supported by the fixed frame **130**, and the movable frame **133** is pulled in the direction of arrow "h" with the side wall **133***a* pressed by a coil spring **132**.

Further, on the locus of the upward/downward movement of the sheet set conveyer gate **100**, a guide member **135** which has a concave cross section is provided, and by providing a rail **136** in the center of the guide member **135**, two guide grooves **135***a* and **135***b* which extend vertically are formed in the guide member **135**. A diverter **137** is fitted to the lower end of the rail **136** via a pin **138** and is capable of swinging, and the diverter **137** is connected to a solenoid SL**51**. While the solenoid SL**51** is off, the diverter **137** is in a position in the center of the guide member **135** as shown by the solid line in FIG. **19**. When the solenoid SL **51** is turned on, the diverter **137** swings to the right and comes to a position shown by the two-dot chain line. A pin **134** is fixed on the side wall **133***a* of the movable frame **133**. The pin **134** is in the guide member **135** and is movable in the guide grooves **135***a* and **135***b*.

In the structure, the solenoid SL**51** is usually off, and the gate **100** moves up and down while the movable frame **133**

is pulled by the coil spring **132** so that the pin **134** is in engagement with the guide groove **135***a*. In this state, the movable frame **133** is not shifted. On the other hand, when the gate **100** moves up holding an unstapled set of sheets S in an even number between the rollers **102** and **103**, the solenoid SL**51** is turned on. Thereby, the diverter **137** swings to the right, and the pin **134** enters the guide groove **135***b* in the middle of the upward movement, guided by the diverter **137**. Thus, the movable frame **133** and accordingly the rollers **102** and **103** are shifted by the distance W. The gate **100** moves up to the delivering position keeping this state, and delivers the set of sheets to the tray **20**. When the gate **100** transports unstapled sets of sheets in odd numbers, the solenoid SL**51** is kept off. In this way, as FIG. **20** shows, unstapled sets of sheets S_1, S_2, S_3 . . . are stacked on the non-sort tray **20** in a state of shifting in right and left alternately by the distance W.

In this embodiment, this shift stacking of sets of sheets on the non-sort tray **20** is carried out when the sets of sheets are unstapled. However, needless to say, the shift stacking may be carried out also when stapled sets of sheets are stacked on the tray **20**.

Next, pressing sticks **140** which press sheets stacked on the non-sort tray **20** at the trailing portion are described. The pressing sticks **140** are located in a position as shown in FIG. **21** with respect to the delivering direction, and as shown in FIG. **23***a*, when a set of sheets S_2 is to be delivered to the non-sort tray **20**, the sticks **140** pivot in the direction of arrow "i" to press down a set of sheets S_1 on the non-sort tray **20** at its trailing portion. When the set of sheets S_2 is delivered to the non-sort tray **20** on the set of sheets S_1, the set of sheets S_2 which is provided with a force by the gate rollers **102** and **103** may push the set of sheets S_1 forward. In this embodiment, it is possible to stack unstapled sets of sheets on the non-sort tray **20**, and in this case, it is more likely to occur that upper sheets in an unstapled set on the tray **20** are pushed forward. In order to avoid such trouble, the pressing sticks **140** are provided.

Referring to FIGS. **22** and **23***a*, the structure of the pressing sticks **140** is described. Each of the pressing sticks **140** has a rubber member **140***a* which has a large coefficient of friction on its end. The pressing sticks **140** stand on a pipe **141** which extends in parallel to the roller shafts **122** and **123**, and a shaft **142** is inserted in the pipe **141**. The pipe **141** and the shaft **142** rotates freely from each other and are connected to each other via torque limiters **143** and **144**. A gear **146** fixed to the shaft **142** is in engagement with a gear **127** fixed to the lower roller shaft **123** via an idle gear **145**.

The pressing sticks **140** are usually upright as shown in FIG. **23***a*. When the gate rollers **102** and **103** are driven to rotate for delivery of the set of sheets S_2 to the non-sort tray **20**, as shown in FIGS. **22** and **23***b*, the rotating force is transmitted to the pipe **141** from the gear **127** via the idle gear **145**, the gear **126**, the shaft **142** and the torque limiter **143**. Then, the pressing sticks **140** pivot in the direction of arrow "i" with rotation of the pipe **141**, and the rubber members **140***a* press down the set of sheets S_1 on the tray **20** at the trailing portion. Thereafter, the gate rollers **102** and **103** keep rotating to deliver the set of sheets S_2 onto the tray **20**, and accordingly, the gear **146** and the shaft **142** keep rotating, whereas the pressing sticks **140** stay in the pressing position regulated by the torque limiter **143**. In this way, it is prevented that the set of sheets S_1 may be pushed forward by the set of sheets S_2.

After delivering the set of sheets S_2 onto the non-sort tray **20**, the gate rollers **102** and **103** are rotated in the reverse direction to the direction for the delivery for a short time. In this moment, the rotating force is transmitted to the pipe **141** from the gear **147** via the other torque limiter **144**, and as shown in FIG. **23***c*, the pressing sticks **140** pivot in the direction of "i" with rotation of the pipe **141** to release the set of sheets S_1. When the pressing sticks **140** come upright to the position shown in FIG. **23***c*, the pressing sticks **140** are stopped from pivoting in the direction of arrow "i'" by a stopper (not shown) to stay in the upright position.

In the non-sort mode, the torque limiter **143** is kept off, and the pressing sticks **140** are not operated and stay in the upright position.

Among the pressing sticks **140**, two sticks **140**(*a*) in the center (see FIG. **21**) especially function as a prevention against push-out of a set of sheets. A pressing stick **140**(*b*) at the right end in FIG. **21** presses a set of sheets S at a corner into a recess **20***a* formed on the non-sort tray **20**. When sets of sheets each of which has been stapled at a corner are stacked on the non-sort tray **20**, the staples are laid one upon another over the recess **20***a*, and the stack of the sheet sets is more voluminous in this portion. By pressing the stack of the sheet sets at the stapled portion into the recess **20***a*, the upper surface of the stack can be made flat at a time of delivery of a set of sheets onto the tray **20**, whereby interference among the sets of sheets can be prevented, thereby securing alignment of the sets of sheets on the tray **20**.

By the way, in the take-out/transportation/stacking of sets of sheets, the bin assembly **30** moves up pitch by pitch. The transportation/stacking of a stapled set of sheets onto the non-sort tray **20** is carried out while sheets in a bin **31** set on the level X_1 are stapled.

In the non-sort mode, the sheet set conveyer gate **100** is in the home position shown in FIG. **11** and delivers sheets onto the non-sort tray **20** one by one. In the modes where the gate **100** transports sets of sheets from the bin assembly **30** to the non-sort tray **20** one by one, the gate **100** is first set in a second position shown by the solid line in FIG. **12** to deliver a set of sheets onto the tray **20**. The tray **20** has a large capacity, and therefore, the gate **100** can be set on any level within a range from the second position to an upper limit position shown by the dashed line in FIG. **12** for delivery of a set of sheets onto the tray **20** so that sets of sheets stacked on the tray **20** can be kept in alignment. The delivering position where the gate **100** is stopped for delivery of a set of sheets onto the tray **20** is such a position as to keep a constant distance between the gate rollers **102** and **103** and the upper surface of the stack of sheet sets on the tray **20**. In other words, for delivery of a set of sheets onto the tray **20**, the gate **100** is set on such a level to drop the set of sheets on the uppermost set of sheets on the tray **20** by a specified height.

The following is the reason why the second position where the gate **100** is set for delivery of the first set of sheets onto the tray **20** is located under the home position where the gate **100** is set for delivery of sheets onto the tray **20** in the non-sort mode. In this embodiment, in the non-sort mode, the position of the gate **100** is fixed. Therefore, in order to secure a sufficient capacity in the tray **20** for sheets, it is necessary to set a sufficient height from the tray **20** to the gate **100**. On the other hand, when a set of sheets is delivered onto the tray **20**, the set of sheets is likely to bend, and it is preferred that the height by which a set of sheets falls down onto the tray **20** from the gate rollers **102** and **103** is small. Therefore, the second position is located under the home position, and the gate **100** is gradually stopped on higher levels as the volume of sets of sheets on the tray **20** is increasing.

In order to realize the movement of the gate **100**, as shown in FIG. **2**, a sensor SE**33** which detects the presence or absence of a sheet on the non-sort tray **20** and a sensor SE**23** which detects the upper surface of a stack of sheets on the tray **20** (the upper surface of the tray **20** if no sheets are on the tray **20**) are provided. Also, a sensor SE**20** which detects that the gate **100** is in the home position and a sensor SE**22** which detects the presence or absence of a set of sheets in the gate **100** are provided. Further, a sensor SE**24** which detects that the gate **100** has moved up to the upper limit is provided (see FIG. **12**).

As shown in FIGS. **11** and **12**, a cover **21** is provided at a position facing the lower end of the non-sort tray **20**. The cover **21** is to regulate the trailing edge of a set of sheets delivered onto the tray **20**. The cover **21** is movable upward together with the gate **100**, whereas the cover **21** stays in the upper position while the gate **100** is moving down to the bin assembly **30**. The cover **21** is supported by a frame having a vertical portion **22***a* and a horizontal portion **22***b*, and the cover **21**, together with the frame, is movable up and down guided by a guide member (not shown). On the body frame **11** of the staple-sorter **10**, a frame **20** with a ratchet **29***a* is fixed, and a pawl **24** which is fitted to the cover **21** via a bracket **23** is in engagement with the ratchet **29***a*. The pawl **24** is capable of pivoting on a pin **24***a* freely in the counterclockwise direction and within a limited rage in the clockwise direction.

When the sheet set conveyer gate **100** is in the second position, the cover **21** is in a position (lowest position) shown by the solid line in FIG. **12**, and the pawl **24** is in engagement with the lowest tooth of the ratchet **29***a*. When the volume of sets of sheets on the tray **20** increases, the gate **100** moves up, and simultaneously, the box **100** pushes up the horizontal frame portion **22***b*, resulting in an upward movement of the cover **21**. During the upward movement, the pawl **24** pivots counterclockwise on the pin **24***a* and goes over the teeth of the ratchet **29***a*. When the gate **100** stops moving up, the pawl **24** comes into engagement with the tooth opposite thereto, and therefore, the cover **21** stays in the position when the gate **100** moves down afterwards. In this way, whenever the gate **100** delivers a set of sheets onto the tray **20**, the upper end **21***a* of the cover **21** is at a specified distance from the nip portion of the rollers **102** and **103**.

The highest position of the cover **21** is shown by the dashed line in FIG. **12**. When the operator has taken the sets of sheets out of the non-sort tray **20**, the pawl **24** is released from the limitation of clockwise pivot (for example, a regulating member retreats from its regulating position with turning-on of a solenoid), and the cover **21** moves down to the lowest position.

FIG. **24** shows the main part of an operation panel **150** provided on the copying machine **1**. On the operation panel **150**, there are provided a liquid crystal display type touch panel **151**, a ten-key **152** for inputting the number of copies to be made (registered number), a reset key **153**, an interruption key **154**, a copy start key **155** and so on.

FIG. **25** illustrates a screen displayed on the touch panel **151**. There are displayed a sort mode sector key **161**, a sort/staple mode selector key **162**, a sort/stack mode selector key **163**, a sort/staple/stack mode selector key **164**, a group mode selector key **165**, a group/staple mode selector key **166**, a group/stack mode selector key **167**, a group/staple/stack mode selector key **168** and a non-sort mode selector key **169**.

FIG. **26** illustrates another screen displayed on the touch panel **151**. On the screen, there is displayed a key **156** which limits the number of copy sets to be made and stacked in the staple/stack mode to **40**.

FIG. **27** shows the control circuit of the copying machine **1** and of the staple-sorter **10**. The center of the control circuit is a CPU **170** with a ROM **171** and a RAM **172**, and the CPU controls the motors M**20**, M**21**, M**50**, M**60** M**70**, the solenoids SL**50**, SL**51**, the staple unit shift motor, the staple unit drive motor, etc. according to a program stored in the ROM **171**. Meanwhile, detection signals are inputted into the CPU **170** from the above-described various sensors. Further, the CPU **170** communicates with other CPUs, for example, with a CPU **173** which controls the automatic document feeder **5** to exchange necessary data.

Referring to flowcharts of FIGS. **28** through **38**, the control procedure of the CPU **170** is hereinafter described.

First, various flags and counters shown in the flowcharts are described.

A sort flag F**1** indicates that the sort mode has been established.

A group flag F**2** indicates that the group mode has been established.

A staple flag F**3** indicates that the staple mode has been established.

A stack flag F**4** indicates that the stack mode in which sets of sheets stored in the bins **31** are transported to and stacked on the non-sort tray **20** is established.

An initial gate operation flag F**5** indicates that the sheet set conveyer gate **100** is in its home position.

A staple unit operation flag F**6** permits the staple unit **70** to perform stapling.

A take-out flag F**7** permits the take-out unit **40** and the sheet set conveyer gate **100** to perform take-out/transportation/stacking of a set of sheets.

A take-out unit operation flag F**8** permits the take-out unit **40** to perform take-out of a set of sheets.

A one-bin take-out completion flag F**9** indicates the take-out/transportation/stacking of a set of sheets from one bin has been completed by the take-out unit **40** and the sheet set conveyer gate **100**.

A registered number counter A stores the number of copies to be made registered by the operator.

A job counter B counts the number of times of circulation of documents in the automatic document feeder **5**. Because there are only twenty bins, if the registered number is more than 20 in the sort mode, documents are circulated a plurality of times, and twenty copies of each document are made in each circulation. For example, if the registered number is "50", in the first circulation of documents, twenty copies of each document are made and distributed among the bins $\mathbf{31}_1$ through $\mathbf{31}_{20}$. This is defined as "one job", and the counter B is set to 1. After the completion of one job, the twenty sets of sheets stored in the bins **31** are sequentially stapled if necessary and transported and stacked onto the non-sort tray **20** by the sheet set conveyer gate **100**. Thereafter, in the second circulation of the documents, twenty copies of each document are made and distributed among the bins $\mathbf{31}_2$, through $\mathbf{31}_{20}$, and then, these twenty sets are sequentially transported and stacked onto the non-sort tray **20**. Further, in the third circulation of the documents, ten copies of each document are made and distributed among the bins $\mathbf{31}_1$ through $\mathbf{31}_{10}$, and then, these ten sets are sequentially transported and stacked onto the non-sort tray **20**.

A bin counter C indicates the number of bins to be used in one job. For example, if the registered number is "30", the

counter C indicates "20" in the first job and indicates "10" in the second job.

A take-out bin counter D indicates the number of bins which sheets have not been taken out of, in the stack mode.

A travel summation counter E counts the travel distance of the vertical movement of the gate **100** in the stack mode.

A first travel constant counter F counts the travel distance (a constant) of the gate **100** from the home position to the take-out position for receiving a set of sheets from a bin.

A second travel constant counter G counts the travel distance (a constant) of the gate **100** from the home position to the second position.

A total travel counter H counts the travel distance of the gate **100** from the take-out position to a delivering position to deliver a set of sheets to the non-sort tray **20**.

A stapled-bin counter I counts the number of bins where stapling has been performed.

A group storing bin counter J counts the number of bins which have been stored with sheets in the group mode. The value of this counter depends on the number of documents.

A stacking start position counter K counts the travel distance of the gate **100** from the take-out position to a position where the first set of sheets is delivered from the gate **100** to the non-sort tray **20**.

In the following description, the term "on-edge" means a moment when a sensor, a signal or the like is switching from off to on, and the term "off-edge" means a moment when a sensor, a signal or the like is switching from on to off.

FIG. **28** shows the main routine of the CPU **170**.

When the system is powered on and the program starts, first at step **S1**, control parameters and devices are initialized, and at step **S2**, an initial gate operation is carried out. Next, an internal timer is started at step **S3**. The internal timer is to determine the time for one routine, and the value has been previously set in the timer at step **S1**. Subsequently, subroutines are called at steps **S4**, **S5**, **S6**, **S7** and **S8** to perform necessary processes. When the end of the internal timer is confirmed at step **S9**, the program returns to step **S3**.

FIG. **29** shows a subroutine for the initial gate operation which is carried out at step S_2 of the main routine. In this subroutine, the sheet set conveyer gate **100** is set in the home position.

First, the initial gate operation flag **F5** is checked at step **S11**. If the flag **F5** is "0", the sensor **SE20** is checked at step **S12**. The sensor **SE20** is on while the gate **100** is above the home position and off while the gate **100** is below the home position. Therefore, if the sensor **SE20** is on at step **S12**, the gate up/down motor **M20** is rotated forward at step **S13**. Thereby, the gate **100** starts moving down. Next, an off-edge of the sensor **SE20** is checked at step **S14**. At an off-edge of the sensor **SE20**, that is, when the gate **100** has reached the home position, the flag **F5** is set to "1" at step **S15**, and the motor **M20** is stopped at step **S16**. On the other hand, when the sensor **SE20** is off at step **S12**, which means that the gate **100** is below the home position, the motor **M20** is rotated in reverse at step **S17**. Thereby, the gate **100** starts moving up. Next, an on-edge of the sensor **SE20** is checked at step **S18**. At an on-edge of the sensor **SE20**, the motor **M20** is stopped at step **S16**. Thereafter, the gate **100** is set in the home position through the steps **S12** to **S16**.

FIG. **30** shows a subroutine for an input process which is carried out at step **S4** of the main routine. In this subroutine, information on mode selection inputted by an operator with the operation panel **150** is put into the CPU **170**.

First at step **S21**, it is judged whether the machine is in operation for copying, and if it is in the middle of copying, a mode switch process is executed at step **S22**. If it is not in the middle of copying, a mode input process is executed at step **S23**, and other input processes, for example, input of a number registered by the operator on the ten-key **152** into the CPU **170**, are executed at step **S24**. Next, it is judged at step **S25** whether or not the stack flag **F4** is "0"; it is judged at step **S26** whether or not the sort flag is "1"; and it is judged at step **S27** whether or not the registered number is larger than **20**. If the judgments at all the steps **S25**, **S26** and **S27** are "YES", the stack flag **F4** is set to "1" at step **S28**. In this case, because the registered number is over the number of bins, this copying operation cannot be completed in one job. Therefore, in order to automatically transport/stack sets of sheets from the bins **31** onto the non-sort tray **20** after one job, the flag **F4** is set to "1". In this way, even if the operator has not selected the stack mode, the stack mode is automatically established so that the operation in the sort mode to make 21 or more copy sets can be continuously carried out.

Next, the staple flag **F3** is checked at step **S29**. If the flag **F3** is "1" and if the registered number is judged to be more than 40 at step **S30**, an excess stack process is executed at step **S31**. If a large number of stapled sets of sheets are stacked on the non-sort tray **20**, the stack of sheet sets will be voluminous especially at the stapled portion, and the stapled portion may have a height over the capacity of the non-sort tray **20**. In order to avoid this trouble, a limit is set to the number of sheet sets to be stacked on the tray **20** in the staple/stack mode. This limit is "40" in this embodiment.

If the stack mode has been selected by the operator ("NO" at step **S25**) and if the sort flag **F1** is "1" at step **S32**, processes at the steps **S29** and **S30** are executed in the above-described way. Then, if the number of sheet sets to be stacked on the tray **20** is more than 40, the excess stack process is executed at step **S31**.

Thus, in the sort/staple/stack mode, if the number of sheet sets to be stacked on the tray **20** is more than 40, the registered number is automatically changed to "40". However, after stacking 40 stapled sets of sheets on the tray **20**, it is possible to make more copy sets in the sort/staple mode. Therefore, the system can be so structured that the stacking is discontinued when 40 sets have been stacked on the tray **40**, while copying in the sort/staple mode thereafter to make not more than 20 sets is permitted.

FIG. **31** shows a subroutine for the mode switch process which is carried out at step **S22**.

If the stack flag **F4** is judged to be "0" at step **S41** and if the group flag **F2** is judged to be "1" at step **S42**, it is judged at step **S43** whether or not the number of documents is more than 20. The number of documents is counted every time the automatic document feeder **5** feeds a document onto the platen glass. Specifically, the presence or absence of a document on the document tray of the document feeder **5** is checked during copying of the nineteenth document, and if there is a document on the tray at this time, the document is the twenty-first document. Accordingly, in this case, the judgment at step **S43** is "YES". Because there are only twenty bins, copies of the twenty-first document cannot be delivered to any bin **31**. Therefore, the stack flag **F4** is set to "1" at step **S44**. Thereby, sets of sheets stored in the bins **31**, sheets in each set having the same page, are transported and stacked onto the non-sort tray **20** by the sheet set conveyer gate **100**, so that copying of the twenty-first and succeeding documents becomes possible.

Next, the staple flag **F3** is checked at step **S45**. If the staple flag **F3** is "1" and if the number of documents is judged to

be more than 40, the excess stack process is executed at step S47. As in the case where the number of copy sets to be made is judged to be more than 40 at step S30, in order to avoid trouble that the height of the stack of sheet sets on the non-sort tray 20 may be over the capacity of the tray 20, the number of stapled sets to be stacked on the tray 20 is limited.

On the other hand, if the stack mode has been selected ("NO" at step S41) and if the group flag F2 is judged to be "1" at step S48, the program goes to steps S45 and S46. Then, if the number of sheet sets to be stacked on the tray 20 is more than 40, the excess stack process is executed at step S47. In the group/staple/stack mode, if the number of sheet sets to be stacked on the tray 20 is more than 40, stacking of the forty-first and succeeding sets is cancelled.

FIGS. 32*a* and 32*b* show a subroutine for the mode input process which is carried out at step S23.

In this subroutine, the on/off states of the mode selector keys 161 through 169 on the touch panel 151 are judged at steps S51, S53, S55, S57, S59, S61, S63 and S65 respectively, and in accordance with the turned-on keys of the keys 161 through 166, the flags F1 through F4 are set/reset to "1" or "0" at corresponding steps of S52, S54, S56, S58, S60, S62, S64, S66 and S67. Initially, the non-sort mode is established.

FIG. 33 shows a subroutine for the excess stack process which is carried out at steps S31 and S47.

This subroutine is carried out when the registered number is more than 40 in the sort/staple/stack mode (see steps S28, S29, S30 and S32) or when the number of documents is more than 40 in the group/staple/stack mode (see steps S44, S45, S46 and S48).

First, a warning display is presented on the touch panel 151 at step S71. As shown in FIG. 26, the warning display comprises text which indicates that at most 40 sets can be stacked in the staple mode and asks the operator whether stacking of only 40 copy sets on the tray 20 is permissible, and a key 156. If it is judged at step S72 that the operator has turned on the key 156, the sort flag F1 and the group flag F2 are checked at steps S73 and S75. If the sort mode is set, the registered number is changed to 40 at step S74, and if the group mode is set, the take-out flag F7 is reset to "0".

FIG. 34 shows a subroutine for a finish process which is carried out at step S5 of the main routine. In this subroutine, processes specified by the flags are executed.

If the sort flag F1 is "1" at step S81, control for sorting is executed at step S82. If the group flag F2 is "1" at step S83, control for grouping is executed at step S84. At step S85, control for the vertical movement of the bins 31 is executed. Further, if condition "A−20B>20". In other words, it is judged whether or not the number of copy sets to be made is more than 20. If "YES" at step S108, the value of the bin counter C is set to 20 at step S109. If "NO" at step S108, the value of the bin counter C is set to "A−20B". With this process at step S109 or S110, the number of bins to be used in the currently starting job is set in the bin counter C, and the same value is set in the take-out bin counter D at step S111. Then, the state counter SCI is set to "2".

When the state counter SC1 is "2", the completion of one job is confirmed at step S113. Then, the value of the job counter B is increased by one at step S114, and the state counter SC1 is set to "4".

When the state counter SC1 is "3", the completion of one job is confirmed at step S116. Then, the value of the group storing bin counter J is set in the bin counter C at step S117, and the state counter SC1 is set to "4" at step S118.

When the state counter SC1 is "4", the staple flag F3 is checked at step S119. If the flag F3 is "1", the first bin 31_1 is moved to the level X_1 at step S120. At this step, the first bin 31_1 is set in a stapling position, and the bins 31 are prepared to be sequentially subjected to stapling. Then, the completion of the movement of the bin 31_1 is confirmed at step S121, and the state counter SC1 is set to "5" at step S122.

On the other hand, if the staple flag F3 is "0", the first bin 31_1 is moved to the level X_2. At this step, the first bin 31_1 is set in a take-out position, and the bin 31 are prepared to be sequentially the staple unit operation flag F6 is "1" at step S86, the staple unit 70 is controlled at step S87. If the take-out flag F7 is "1" at step S88, the take-out unit 40 is controlled at step S89, and the sheet set conveyer gate 100 is controlled at step S90. If it is judged at step S91 that the flags F1 through F4 are all "0", control for non-sorting is executed at step S92.

Since the control for sorting and the control for grouping executed at steps S82 and S84 are well known as control for distributing copies among the bins 31, the descriptions thereof are omitted. Also, the control of the staple unit 70 executed at step S87 is well known as control for striking a staple into a set of sheets, the description thereof is omitted.

FIGS. 35*a* through 35*g* show a subroutine for the control of the bins 31 which is executed at step S85. In this subroutine, the value of a state counter SC1 is checked at step S100, and the program proceeds according to the value.

When the state counter SC1 is "0", the start of copying is confirmed at step S101, and the sort flag F1 is checked at step S102. If the sort flag F1 is "1", the job counter B is reset to "0" at step S103, the stapled-bin counter I is reset to "0" at step S104, and the state counter SC1 is set to "1" at step S105. On the other hand, if the sort flag F1 is "0" ("NO" at step S102), the counter I is reset to "0" at step S106, and the state counter SC1 is set to "3" at step S107.

When the state counter SC1 is "1", it is judged at step S108 whether or not the values of the counters A and B satisfy the subjected to take-out. Then, the completion of the movement of the first bin 31_1 is confirmed at step S124, and the state counter SC1 is set to "11".

When the state counter SC1 is "5", the staple unit operation flag F6 is checked at step S126. When the flag F6 is reset to "0", the value of the stapled-bin counter I is compared with the value of the bin counter C at step S127. If the value of the counter I is smaller than the value of the counter C, the stack flag F4 is checked at step S128. If the flag F4 is "1", the state counter SC1 is set to "12" at step S129. If the flag F4 is "0", the state counter SC1 is set to "6" at step S130. On the other hand, if the value of the counter I is not smaller than the value of the counter C ("NO" at step S127), that is, when all sets of sheets stored in the bins 31 have been subjected to stapling, the state counter SC1 is set to "8" at step S131.

When the state counter SC1 is "6", the bins 31 are moved up by one pitch at step S132. When the completion of the upward movement of the bins 31 is confirmed at step S133, the staple unit operation flag F6 is set to "1" at step S134. Then, the state counter SC1 is set to "7" at step S135.

When the state counter SC1 is "7", the staple unit operation flag F6 is checked at step S136. When the flag F6 is reset to "0", the value of the stapled-bin counter I is compared with the value of the bin counter C at step S137. If the value of the counter I is smaller than the value of the counter C, the state counter SC1 is set to "6" at step S138. On the other hand, if the value of the counter I is not smaller than the

value of the counter C, that is, when all sets of sheets stored in the bins **31** have been subjected to stapling, the state counter SC**1** is set to "15" at step S**139**, and the start of the next job is permitted at step S**140**.

When the state counter SC**1** is "8", the stack flag F**4** is checked at step S**141**. If the flag F**4** is "1", the take-out flag F**7** is set to "1" at step S**142**, and the take-out unit operation flag F**8** is set to "1" at step S**143**. These steps are preparatory steps for take-out of sets of sheets from the bins **31** and transportation/stacking of the sets of sheets onto the non-sort tray **20**. Then, the state counter SC**1** is set to "10" at step S**144**. On the other hand, if the stack flag F**4** is "0" ("NO" at step S**141**), the state counter SC**1** is set to "14" at step S**145**, and the start of the next job is permitted at step S**146**.

When the state counter SC**1** is "9", the bins **31** are moved up by one pitch at step S**147**. When the completion of the upward movement of the bins **31** is confirmed at step S**148**, that is, when one of the bins **31** is set in the take-out position on the level X_2, the state counter SC**1** is set to "10" at step S**149**.

When the state counter SC**1** is "10", the one-bin take-out completion flag F**9** is checked at step S**150**. When the flag F**9** is confirmed to be "1" at step S**150**, the flag **9** is reset to "0" at step S**151**. Next, the value of the take-out bin counter D is checked at step S**152**. If the value of the counter D is larger than 0, the state counter SC**1** is set to "9" at step S**153** so that the next bin **31** can be moved to the level X_2. Further, the take-out unit operation flag F**8** is set to "1" at step S**154**. If the value of the counter D is 0, that is, when all sets of sheets stored in the bins **31** have been taken out thereof, the state counter SC**1** is reset to "0" at step S**155**, and the start of the next job is permitted at step S**156**.

When the state counter SC**1** is "11", the stack flag F**4** is checked at step S**157**. If the flag F**4** is "1", the take-out flag F**7** is set to "1" at step S**158**, and the take-out unit operation flag F**8** is set to "1" at step S**159**. These steps are preparatory steps for take-out of sets of sheets from the bins **31** and transportation/stacking of the sets of sheets onto the non-sort tray **20**. Then, the state counter SC**1** is set to "14" at step S**160**. On the other hand, if the stack flag F**4** is "0" ("NO" at step S**157**), the state counter SC**1** is set to "15" at step S**161**, and the start of the next job is permitted at step S**162**.

When the state counter SC**1** is "12", the take-out flag F**7** is set to "1" at step S**163**, and the take-out unit operation flag F**8** is set to "1" at step S**164**. These steps are preparatory steps for take-out of stapled sets of sheets from the bins **31** and transportation/stacking of the sets of sheets onto the non-sort tray **20**. Then, the state counter SC**1** is set to "14".

When the state counter SC**1** is "13", the bins **31** are moved up by one pitch at step S**166**. When the completion of the upward movement of the bins **31** is confirmed at step S**167**, that is, when the next bin **31** is set in the take-out position on the level X_2, the take-out unit operation flag F**8** is set to "1" at step S**168**. Then, the state counter SC**1** is set to "14" at step S**169**.

When the state counter SC**1** is "14", the one-bin take-out completion flag F**9** is checked at step S**170**. When the flag F**9** is confirmed to be "1" at step S**170**, the flag F**9** is reset to "0" at step S**171**. Next, the value of the take-out bin counter D is checked at step S**172**. If the value of the counter D is larger than 0, the state counter SC**1** is set to "13" at step S**173** so that the next bin **31** can be moved to the level X_2. If the value of the counter D is 0, that is, when all sets of sheets have been taken out of the bins **31**, the sort flag F**1** is checked at step S**174**. If the flag F**1** is "1", it is judged at step S**175** whether or not the value of the registered number counter A and the value of the job counter B satisfy the condition "A>20B". If the counter values satisfy the condition, that is, if the registered number of copy sets have not been made, the state counter SC**1** is set to "1" at step S**176**. If the counter values do not satisfy the condition, that is, when the registered number of copy sets have been made, the state counter SC**1** is reset to "0" at step S**178**.

On the other hand, if the sort flag F**1** is "0" ("NO" at step S**174**), it is judged at step S**177** whether or not there is a pre-fed document. Here, the pre-fed document means the twenty-first document which has been fed to a position right before the platen glass by the automatic document feeder **5**. If there is a pre-fed document, the state counter SC**1** is set to "3" at step S**179**, and if there is no pre-fed document, the state counter SC**1** is reset to "0" at step S**178**.

Then, the start of the next job is permitted at step S**180**, and the stapled-bin counter I is reset to "0" at step S**181**.

When the state counter SC**1** is "15", a timer Ts is started at step S**182**, and the state counter SC**1** is set to "16" at step S**183**. The timer Ts is to automatically start transportation/stacking of sets of sheets from the bins **31** onto the non-sort tray **20** if some sets of sheets are left in the bins **31** even when a specified time has passed.

When the state counter SC**1** is "16", the copy start key **155** is checked at step S**184**. If the key **155** is on, that is, if the next copying has been started, the state counter SC**1** is reset to "0" at step S**185**. If the key **155** is not on, that is, if the next copying has not been started, the timer Ts is checked at step S**186**. When the end of the timer Ts is confirmed at step S**186**, the stack flag F**4** is set to "1" at step S**187**, and the state counter SC**1** is set to "8" at step S**188**. Thereby, sets of sheets left in the bins **31** are transported and stacked onto the non-sort tray **20**.

FIGS. **36***a* and **36***b* show a subroutine for the control of the take-out unit **40** which is carried out at step S**89**. In this subroutine, first, the value of a state counter SC**2** is checked at step S**200**, and the program proceeds according to the value.

When the state counter SC**2** is "0", the motor M**70** is rotated forward at step S**201**. Thereby, the second conveyer section **90** retreats upward, and the upper arm **45** and the upper roller **42** come right above a set of sheets stored in the bins **31** in the take-out position on the level X_2. Next, the sensor SE**54** is checked at step S**202**, and at an on-edge of the sensor SE**54**, that is, on the completion of the movement of the second conveyer section **90**, the motor M**70** is stopped at step S**203**. Then, the state counter SC**2** is set to "1".

When the state counter SC**2** is "1", the take-out unit operation flag F**8** is checked at step S**205**. If the flag F**8** is "1", the take-out bin counter D is checked at step S**206**. If the value of the counter D is 0, that is, when all sets of sheets have been taken out of the bins **31**, the state counter SC**2** is set to "5" at step S**213**. If the value of the counter D is not 0, the sensor SE**35** is checked at step S**207**. The sensor SE**35** is to detect the presence or absence of a set of sheets in a bin **31** set on the level X_2. If the sensor SE**35** is judged to be off (no sheets in the bin **31**) at step S**207**, the take-out unit operation flag F**8** is reset to "0" at step S**208**. If the sensor SE**35** is judged to be on at step S**207**, the motor M**70** is rotated in reverse at step S**209**. Thereby, the lower arm **46** pivots in the direction of arrow "c" (see FIG. **3**), and the lower roller **43** holds up the set of sheets in the bin **31**. Next, when an on-edge of the sensor SE**56** is judged at step S**210**, that is, on the completion of nipping of the set of sheets between the rollers **42** and **43**, the motor M**70** is stopped at step S**211**. Then the state counter SC**2** is set to "2".

When the state counter SC2 is "2", the transport motor M50 is rotated in reverse at step S214. Thereby, the rollers 42 and 43 start rotating to draw the set of sheets out of the bin 31 to the sheet set conveyer gate 100. When the sensor SE21 is judged to be on at step S215, that is, when the set of sheets is being delivered to the gate 100, the state counter SC2 is set to "3" at step S216.

When the state counter SC2 is "3", the sensor SE21 is checked at step S217. At an off-edge of the sensor SE21, that is, when the set of sheets has been completely delivered to the rollers 102 and 103 of the gate 100, the transport motor M50 is stopped at step S218. Then, the state counter SC2 is set to "4" at step S219.

When the state counter SC2 is "4", the motor M70 is rotated in reverse at step S220. Thereby, the lower arm 46 and the lower roller 43 start returning to the home position. Next, an on-edge of the sensor SE55 is judged at step S221, that is, when the return of the lower arm 46 and the lower roller 43 is completed, the motor M70 is stopped at step S222. Then, the take-out unit operation flag F8 is reset to "0" at step S223, and the state counter SC2 is set to "1" at step S224.

When the state counter SC2 is "5", the motor M70 is rotated forward at step S225. Thereby, the second conveyer section 90 starts returning to the home position. Next, an on-edge of the sensor SE53 is judged at step S226, that is, when the return of the second conveyer section 90 is completed, the motor M70 is stopped at step S227. Then, the state counter SC2 is reset to "0" at step S228.

FIGS. 37*a* through 37*h* show a subroutine for the control of the sheet set conveyer gate 100 which is carried out at step S90. In this subroutine, the value of a state counter SC3 is checked at step S230, and the program proceeds according to the value.

When the state counter SC3 is "0", the travel summation counter E is reset to "0" at step S231, and the sensor SE33 is checked at step S232. The sensor SE33 is to detect the presence or absence of a sheet on the non-sort tray 20. If the sensor SE33 is judged to be on at step S232, that is, if there are any sheets on the tray 20, the state counter SC3 is set to "3" at step S233. If the sensor SE33 is judged to be off, that is, if there are no sheets on the tray 20, the state counter SC3 is set to "1" at step S234.

When the state counter SC3 is "1", the gate home position sensor SE20 is checked at step S235. If the sensor SE20 is on, that is, if the gate 100 is above the home position, the gate up/down motor M20 is rotated forward at step S236 to move down the gate 100. When an off-edge of the sensor SE20 is judged at step S237, the motor M20 is stopped at step S240. On the other hand, if the sensor SE20 is judged to be off at step S235, that is, if the gate 100, is below the home position, the motor M20 is rotated in reverse to move up the gate 100. When an on-edge of the sensor SE20 is judged at step S239, the motor M20 is stopped at step S240. Next, at step S241, the value of the second travel constant counter G, which indicates the travel distance of the gate 100 from the home position to the second position, is set in the total travel counter H. Then, the state counter SC3 is set to "2" at step S242.

When the state counter SC3 is "2", the gate 100 is moved to the second position. First, the motor M20 is rotated forward at step S243 to move down the gate 100. Next, the total travel counter H is checked at step S244. If the value of the counter H is not 0, the value of the counter H is reduced by one at step S249. The value of the counter H decreases in accordance with the rotation of the motor M20. When the value of the counter H becomes 0, the motor M20 is stopped at step S245. Simultaneously, at step S246, a value calculated by subtracting the value of the second travel constant counter G from the value of the first travel constant counter F is set in the stacking start position counter K. The value "F−G" indicates the travel distance for the gate 100 to reach the take-out position from the second position. Then, the same value is set in the total travel counter H at step S247, and the state counter SC3 is set to "4" at step S248.

When the state counter SC3 is "3", the sensor SE23 is checked at step S250. The sensor SE23 is to detect the upper surface of a stack of sheets on the non-sort tray 20. If the sensor SE23 is judged to be on at step S250, the motor M20 is rotated in reverse to move up the gate 100. Next, the value of the travel summation counter E is increased by one at step S252. The value of the counter E increases in accordance with the rotation of the motor M20. Then, when the sensor SE23 is turned off, the motor M20 is stopped at step S253, and a value calculated by adding the value of the travel summation counter E to the value of the first travel constant counter F is set in the stacking start position counter K at step S254. The value "E+F" indicates the travel distance for the gate 100 to reach the take-out position from the position. Next, the same value is set in the total travel counter H at step S255, and the travel summation counter E is reset to "0" at step S256. Then, the state counter SC3 is set to "4" at step S257.

When the state counter is "4", the total travel counter H is checked at step S258. If the value of the counter H is not 0, the motor M20 is rotated forward at step S259 to move down the gate 100. Next, the value of the total travel counter H is reduced by one at step S260. The value of the counter H decreases in accordance with the rotation of the motor M20. When the value of the counter H becomes 0 ("NO" at step S258), the motor M20 is stopped at step S261. Next, it is confirmed at step S262 that a bin 31 is set on the level X_2, and the sensor SE35 is checked at step S263. The sensor SE35 is to detect the presence or absence of a sheet in the bin 31 set on the level X_2. If the sensor SE35 is on (the presence of a sheet), the state counter SC3 is set to "5" at step S264. If the sensor SE35 is off (the absence of a sheet), a value calculated by adding the value of the travel summation counter E and the value of the stacking start position counter K is set in the total travel counter H at step S265, and the state counter SC3 is set to "9" at step S266. The value "E+K" indicates the travel distance for the gate 100 to reach the delivering position from the take-out position. Thus, if there are no sheets in the bin 31 on the level X_2, the gate 100 is once returned to the delivering position.

When the state counter SC3 is "5", the sensor SE21 is checked at step S267. The sensor SE21 is to detect a set of sheets being taken out of a bin 31 and delivered toward the gate 100 by the take-out unit 40. When the sensor SE21 is turned on, the state counter SC3 is set to "6" at step S268.

When the state counter SC3 is "6", at step S269, the roller drive motor M21 is rotated forward at a speed A. The speed A of the motor M21 is such a speed that the rollers 102 and 103 can be rotated to have a higher transporting speed than the transporting speed of the rollers 42 and 43 of the take-out unit 40. With the rotation of the motor M21, the rollers 102 and 103 are rotated forward and receive a set of sheets from the take-out unit 40. When an off-edge of the SE21 is judged at step S270, that is, when the set of sheets has been completely taken out of the bin 31 and received by the gate 100, a timer Tg is started at step S271. Simultaneously, the speed of the motor M21 is reduced to a speed B at step S272, and the state counter SC3 is set to "7" at step S273.

When the state counter SC3 is "7", the timer Tg is checked at step S274. When the end of the timer Tg is confirmed at step S274, the motor M21 is stopped at step S275. The timer Tg counts a time which is required for the set of sheets nipped between the rollers 102 and 103 to come to the state shown in FIGS. 13c and 15. Then, a value calculated by adding the value of the travel summation counter E to the value of the stacking start position counter K is set in the total travel counter H at step S276, and the state counter SC3 is set to "8" at step S277. The value indicates the travel distance for the gate 100 to reach the previous delivering position.

When the state counter SC3 is "8", the staple flag F3 is checked at step S278. If the flag F3 is "0", that is, if the set of sheets to be transported to the non-sort tray 20 by the gate 100 is unstapled, it is judged at step S279 whether or not a value calculated by subtracting the value of the take-out bin counter D from the value of the bin counter C is an even number. The value indicates the ordinal number of the bin where the set of sheets to be transported to the tray 20 was stored. If this value is an even number, the solenoid SL51 is turned on at step S280 to shift the movable frame 133 (see FIG. 19) during the upward movement of the gate 100, whereby the set of sheets is delivered onto the tray 20 shifting from a set of sheets previously delivered to the tray 20. Then, the state counter SC3 is set to "9" at step S281.

When the state counter SC3 is "9", the total travel counter H is checked at step S282. If the value of the counter H is not 0, the gate up/down motor M20 is rotated in reverse at step S283 to move up the gate 100. Next, the value of the counter H is reduced by one at step S284. The value of the counter H decreases in accordance with the rotation of the motor M21. When the value of the counter becomes 0 ("NO" at step S282), the motor M20 is stopped at step S285, and the solenoid SL51 is turned off at step S286. Then, the state counter SC3 is set to "10" at step S287.

When the state counter SC3 is "10", the roller drive motor M21 is rotated in reverse at step S288. Thereby, the rollers 102 and 103 are rotated in reverse to deliver a set of sheets to the non-sort tray 20. Next, the sensor SE23 which detects the upper surface of a stack of sheets on the tray 20 is checked at step S289. If the sensor SE23 is on, the motor M20 is rotated in reverse to move up the gate 100 at step S290, and the value of the travel summation counter E is increased by one. When the sensor SE23 is turned off, the motor M20 is stopped at step S294, and the state counter SC3 is set to "11" at step S295. In this way, as the volume of the stack of sheets on the non-sort tray 20 is increasing, the delivering position of the gate 100 is set higher.

During the upward movement of the gate 100, the sensor SE24 is checked at step S292. When the sensor SE24 is turned on, that is, when the tray 20 has been stored with sheets to its capacity, the take-out flag F7 is reset to "0" at step S293. Thereby, transportation/stacking of succeeding sets of sheets onto the tray 20 is cancelled.

When the state counter SC3 is "11", the sensor SE22 is checked at step S296. At an off-edge of the sensor SE22, that is, when a set of sheets has been delivered from the gate 100 to the tray 20, the motor M21 is stopped at step S297. Then, the value of the take-out bin counter D is reduced by one at step S298, and the state counter SC3 is set to "12".

When the state counter SC3 is "12", the take-out bin counter D is checked at step S300. If the value of the counter D is 0, the sort flag F1 is checked at step S301. If the flag F1 is "1", it is judged at step S302 whether or not the value of the registered number counter A and the value of the job counter B satisfy the condition "A>20B". If the condition is fulfilled, that is, if the copying is to be continued, a value calculated by adding the value of the travel summation counter E to the value of the stacking start position counter K is set in the counter H at step S305. Next, the one-bin take-out completion flag F9 is set to "1" at step S306, and the take-out flag F7 is reset to "0" at step S307. Then, the state counter SC3 is set to "4". If the condition "A>20B" is not fulfilled ("NO" at step S302), that is, if the copying to make the registered number of copy sets has been completed, the state counter SC3 is set to "13" at step S303.

If the copying is in the group mode ("NO" at step S301), it is judged at step S304 whether or not there is a pre-fed document (see step S177). If there is a pre-fed document, the copying is to be continued, the processes at steps S305 through S308 are executed. If there is no pre-fed document, the state counter SC3 is set to "13" at step S309.

On the other hand, if the value of the take-out bin counter D is not 0 ("NO" at step S300), in order to take a set of sheets out of the next bin, a value calculated by adding the value of the travel summation counter E to the value of the stacking start position counter K is set in the total travel counter H at step S310. Next, the one-bin take-out completion flag F9 is set to "1" at step S311, and the state counter SC3 is set to "4" at step S312.

When the state counter SC3 is "13", if the gate 100 is above the home position, the gate 100 is returned to the home position 100. The home position sensor SE20 is checked at step S313, and if the sensor SE20 is on, the gate up/down motor M20 is rotated forward to move down the gate 100. When the sensor SE20 is turned off ("NO" at step S313), the motor M20 is stopped at step S315. Next, the take-out flag F7 is reset to "0" at step S316, and the one-bin take-out completion flag F9 is set to "1" at step S317. Then, the state counter SC3 is reset to "0" at step S318.

FIG. 38 shows a subroutine for the control for non-sorting which is carried out at step S92. In this subroutine, first, the value of a state counter SC4 is checked at step S320, and the program proceeds according to the value.

When the state counter SC4 is "0", it is judged at step S321 whether or not start of copying has been commanded. If the start of copying is judged, the sensor SE33 is checked at step S322. If the sensor SE33 is on, which means that there is a sheet on the non-sort tray 20, a warning display is presented on the touch panel 151 at step S323. If the non-sort tray 20 is empty ("NO" at step S322), the gate 100 and the bin assembly 30 are returned to the respective home positions at step S324.

Next, when the return of the gate 100 and the bin assembly 30 is confirmed at step S325, execution of copying is permitted at step S326. Subsequently, at step S327, the solenoid SL50 is turned on, the transport motor M50 is rotated forward, and the roller drive motor M20 is rotated in reverse. Thereby, the diverter 82 is set in the position to guide a sheet to the non-sort tray 20, and sheets ejected from the copying machine 1 are delivered to the non-sort tray 20 directly. Then, the state counter SC4 is set to "1" at step S328. Until the gate 100 and the bin assembly 30 has returned to the respective home positions, at step S329, the copying is stopped from starting.

When the state counter SC4 is "1", it is judged at step S330 whether the copying is completed. When the completion of the copying is judged, at step S331, the solenoid SL50 is turned off, and the motors M50 and M20 are stopped. Then, the state counter SC4 is reset to "0" at step S332.

The present invention is applicable not only to a staple-sorter attached to a copying machine but also to a staple-sorter attached to a printer which outputs image data transmitted from a host computer as a hard copy.

The bin assembly **30** and the sheet conveyer section **80** may have any structure. For example, if such a staple-sorter is to be attached to a copying machine or a printer which has an image memory and is capable of forming images in order of page to make a desired number of copy sets, only a single bin **31**, not a plurality of bins **31**, is necessary. Also, it is possible to provide a stale bin where stapling is performed besides the sort bins **31**.

Although the present invention has been described with reference to the preferred embodiment above, it is to be noted that various changes and modifications are possible to those who are skilled in the art. Such changes and modifications are to be noted as being within the scope of the present invention.

What is claimed is:

1. A sheet handling apparatus comprising:

a tray which can receive a large number of sheets thereon;

a plurality of bins among which sheets are distributed for sorting;

conveying means which transports a set of sheets from each of the bins to the trays and delivers the set of sheets onto the tray; and

pressing means which presses sets of sheets which have been delivered and stacked on the tray when a set of sheets is being delivered onto the tray, said pressing means being connected to said conveying means.

2. The sheet handling apparatus as claimed in claim **1**, wherein the pressing means is disposed at an entrance side of the tray.

3. The sheet handling apparatus as claimed in claim **1**, wherein the conveying means has a pair of rollers which nips and holds a set of sheets.

4. The sheet handling apparatus as claimed in claim **3**, wherein the conveying means rotates the pair of rollers near the entrance of the tray to deliver a set of sheets onto the tray.

5. The sheet handling apparatus as claimed in claim **4**, wherein the pressing means moves to a position to press sets of sheets on the tray with the rotation of the rollers.

6. The sheet handling apparatus as claimed in claim **5**, wherein the pressing means comes to press sets of sheets on the tray with the rotation of the rollers for delivery of a set of sheets onto the tray and releases the sets of sheets with reverse rotation of the rollers.

7. The sheet handling apparatus as claimed in claim **6**, wherein the tray is disposed above the plurality of bins.

8. A sheet handling apparatus comprising:

a tray which can receive a large number of sheets thereon;

a plurality of bins among which sheets are distributed for sorting;

conveying means which transports a set of sheets from each of the bins to the trays and delivers the set of sheets onto the tray; and

pressing means connected to the conveying means and which presses sets of sheets which have been delivered and stacked on the tray when a set of sheets is being delivered onto the tray, wherein

the tray has a recess on its bottom surface; and

the pressing means has a plurality of pressing members, at least one of which is disposed opposite the recess.

9. The sheet handling apparatus as claimed in claim **8**, further comprising stapling means which staples a set of sheets, wherein the recess of the tray is formed at a position to receive a stapled portion of a set of sheets.

10. A sheet handling apparatus comprising:

a tray which can receive a large number of sheets thereon;

a plurality of bins among which sheets are distributed for sorting;

take-out means for taking out each set of sheets from each of the bins;

conveying means for receiving said each set of sheets taken out from each of the bins from the take-out means, transporting said each set of sheets from the plurality of bins to the tray and delivering said each set of sheets onto the tray; and

pressing means connected to the conveying means and which presses sets of sheets which have been delivered and stacked on the tray when a set of sheets is being delivered onto the tray.

11. The sheet handling apparatus as claimed in claim **10**, wherein the pressing means is disposed at an entrance side of the tray.

12. The sheet handling apparatus as claimed in claim **10**, wherein the take out means includes a first pair of rollers which nips said each set of sheets and rotate to remove said each set of sheets from a respective bin.

13. The sheet handling apparatus as claimed in claim **12**, wherein the conveying means includes a second pair of rollers which nips and holds said each set of sheets removed from said respective bin by the first pair of rollers during delivery of said each set of sheets to the tray, said second pair of rollers rotate near the entrance of the tray to deliver the held said each set of sheets onto the tray.

14. The sheet handling apparatus as claimed in claim **13**, wherein the pressing means is connected to one roller of said second pair of rollers and moves to a position to press sets of sheets on the tray with the rotation of said second pair of rollers for delivery of said each set of sheets onto the tray.

15. The sheet handling apparatus as claimed in claim **14**, wherein the pressing means releases the sets of sheets on the tray with reverse rotation of the second pair of rollers.

16. The sheet handling apparatus as claimed in claim **15**, wherein the tray is disposed above the plurality of bins.

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